Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

BAKELITE
TRADE MARK

Polyethylene

Flexible piping . . . tough, protective film for packaging . . . insulation for undersea cables . . light, strong, easily moulded containers for domestic use — these are just a few of the many everyday uses of BAKELITE Polyethylene, the multi-purpose plastics material with an outstanding combination of important properties. The development within the BAKELITE organisation of new and improved polyethylene resins and compounds, and constant research into fabrication methods, will result in even wider uses for this versatile material in the future.

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TGA PPAI

NOW reinforced COBEX for extra toughness

Self-supported tank fabricated by Horwitch Smith & Co. Ltd., from transparent COBEX sheet reinforced with expanded metal.

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RIGID VINYL SHEET

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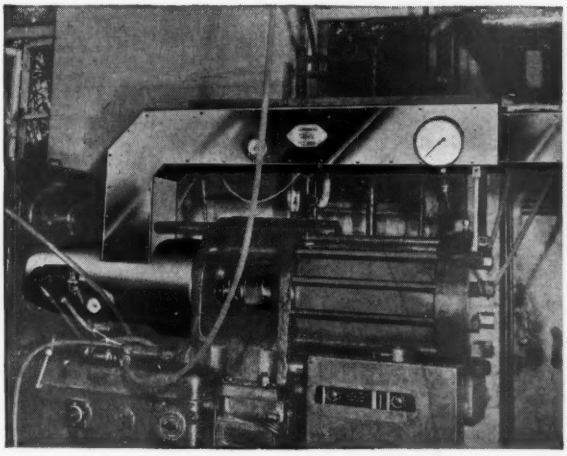
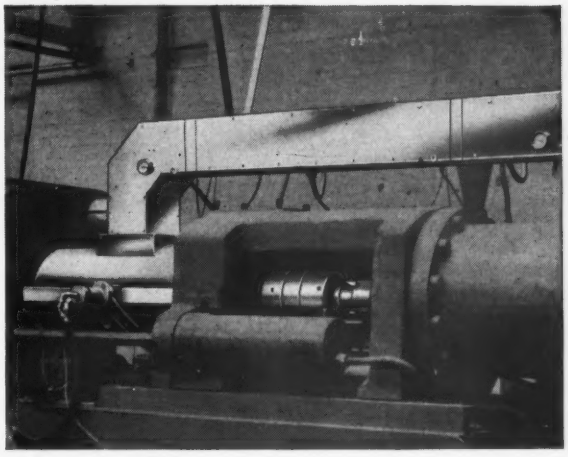
BIGGER SHOTS
FASTER CYCLES
MORE POUNDS PER HOUR



AN 8-OZ. UNIT

PHOTOGRAPHS BY COURTESY OF HALEX



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(COVERED BY U.S.A. PATENT NO. 2790203. WORLD RIGHTS PENDING)

* **READILY ADAPTABLE TO ALL INJECTION-MOULDING AND COMPRESSION PRESSES**
* **2-OUNCE TO 300-OUNCE SIZES**
* **PLASTICISING CAPACITIES UP TO 800 LBS. PER HOUR**

PRODUCTION ADVANTAGES At least 35% cycle increase on every mould. Ounces per shot increased by up to 300%. Casting area increased by 75%. Plasticising capacity increased by at least 100%. Accurate metering saves 4%—9% of material. Extremely rapid colour changes. Quality of moulding clearly improved.

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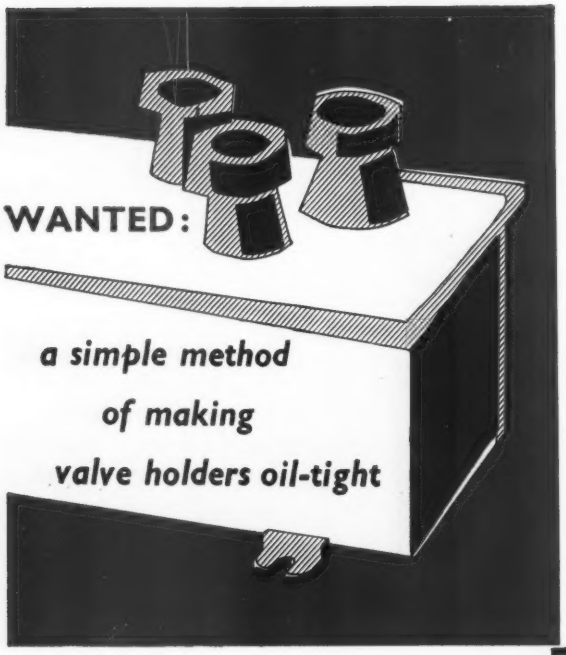
P. & O. HOUSE, 14 COCKSPUR STREET, LONDON, S.W.1

Telephone: WHitehall 0337 **Engineering & Service Division: Croydon**



These valve holders, made by London Transformer Products Ltd., have been developed because of the great difficulty experienced in effecting a completely oil-tight seal on standard valve bases when mounted on oil-cooled transformers. The problem required a material which would withstand high working voltages under adverse conditions of service.

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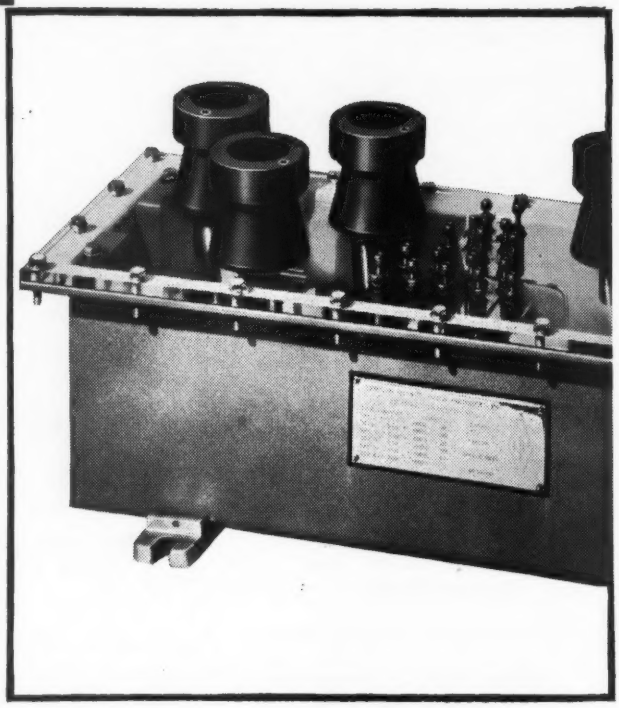
The technical resources behind the Shell organisation will work in close co-operation to solve your production problems by the use of "Epikote" resins.



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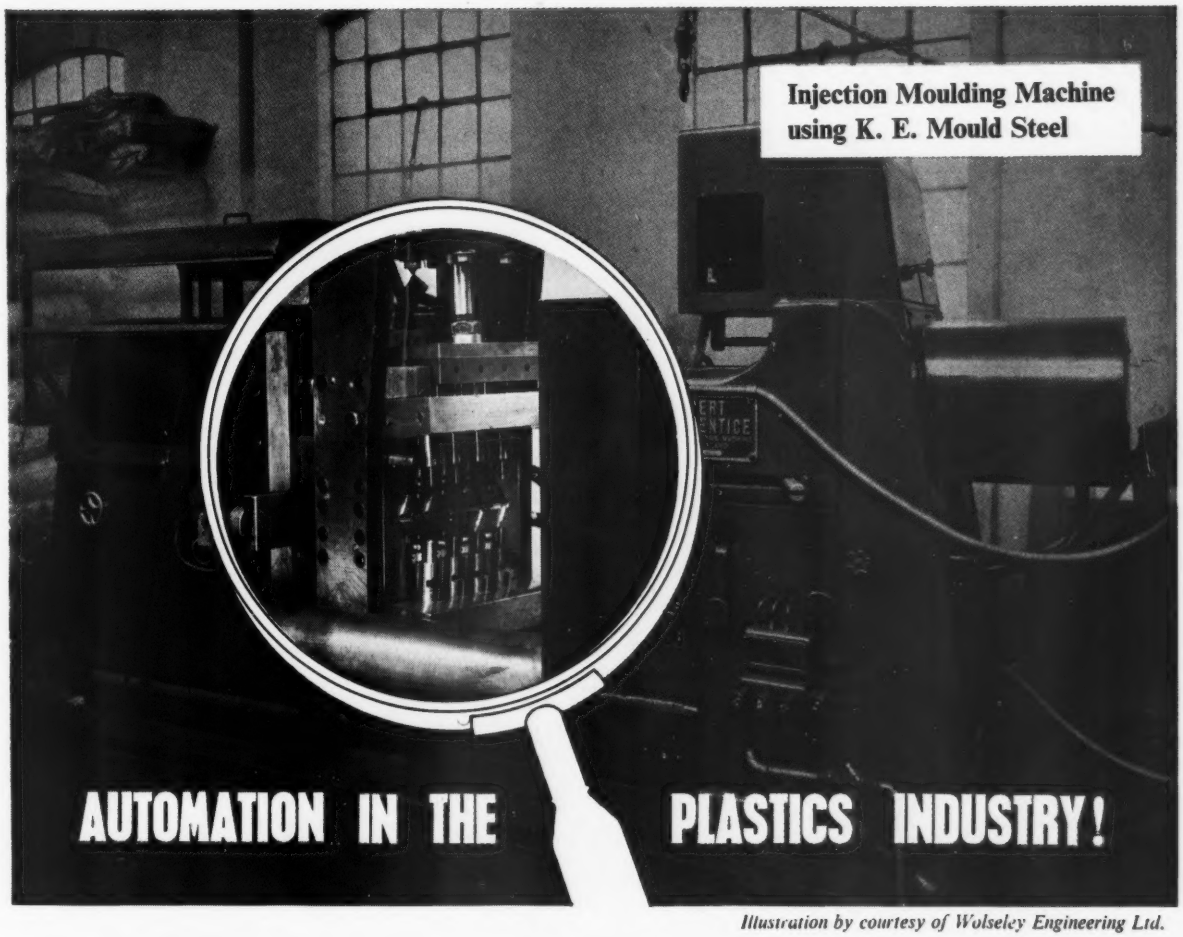

Illustration by courtesy of Wolseley Engineering Ltd.

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(KE) 355 **Special Nickel Chrome Molybdenum Oil or Air Hardening Mould Steel.**

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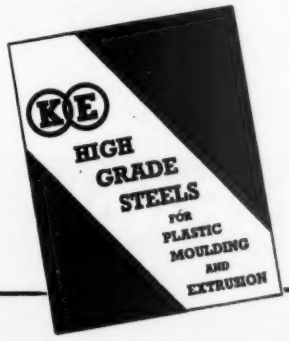

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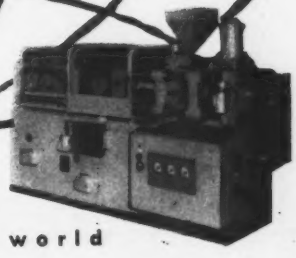

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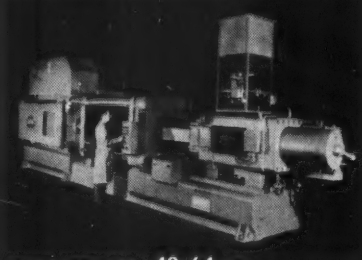

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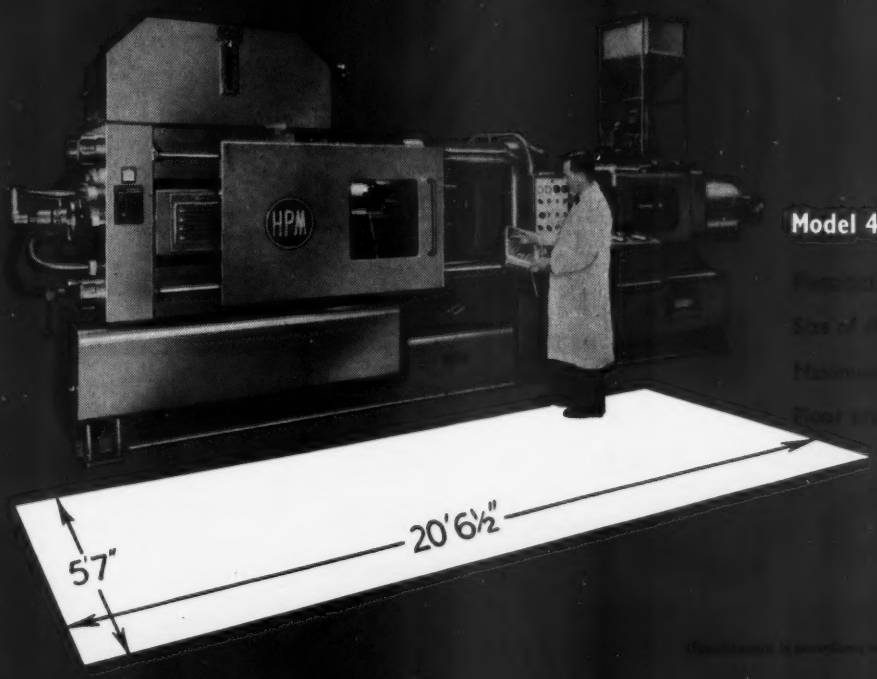

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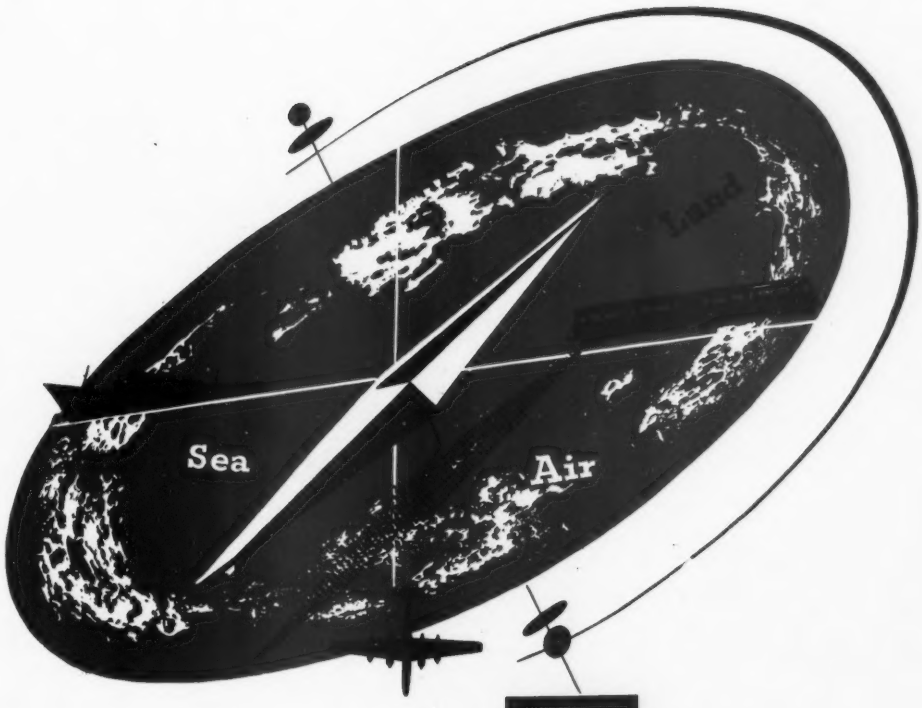

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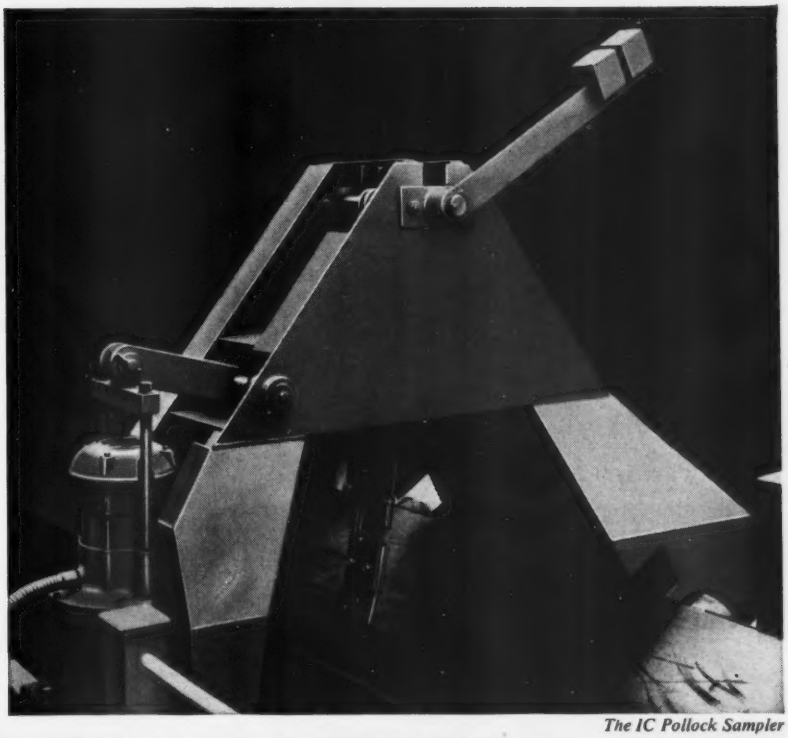
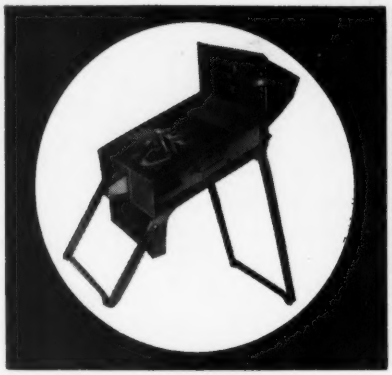


The IC Pollock Sampler



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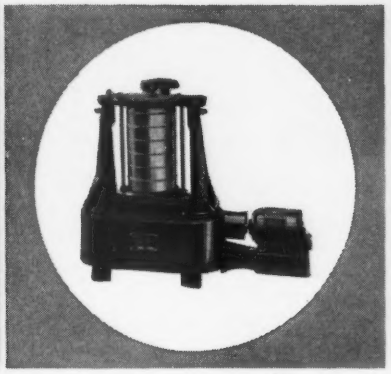

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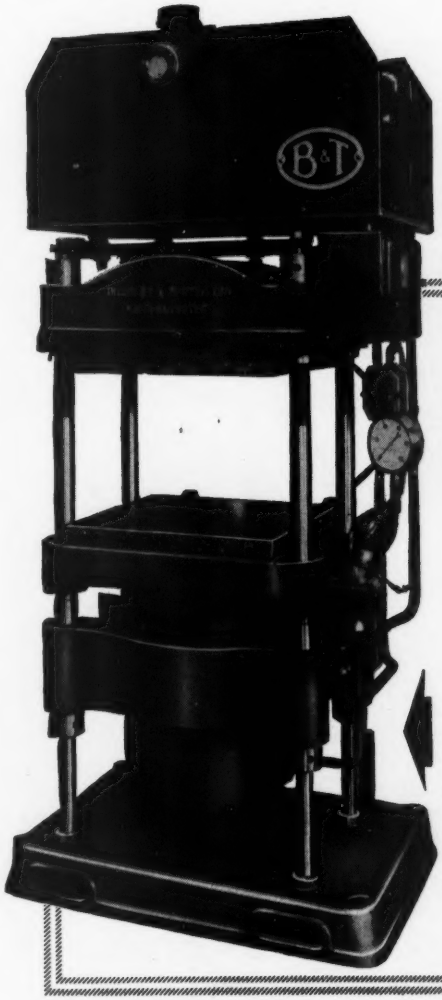

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Suitable for accumulator or direct pump system.

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WITH THE

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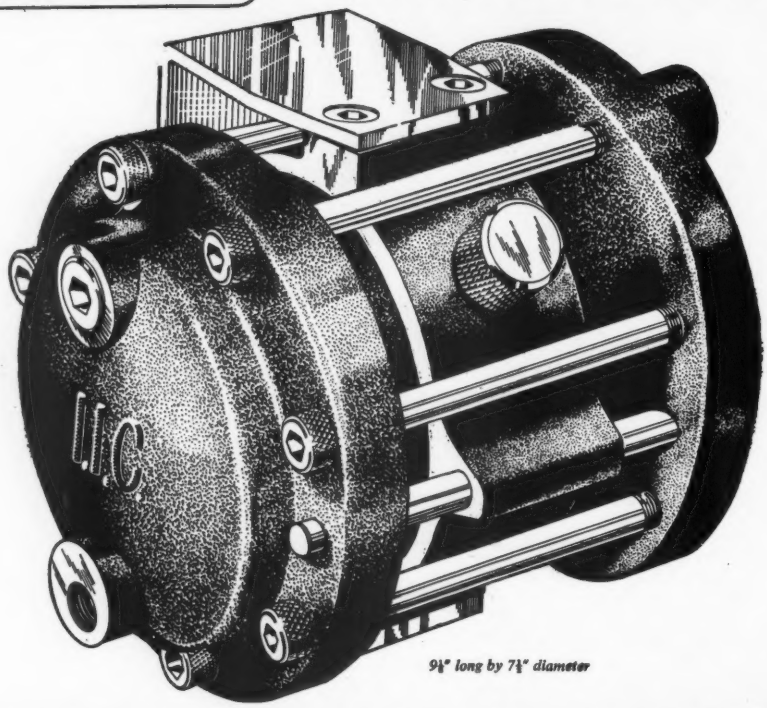

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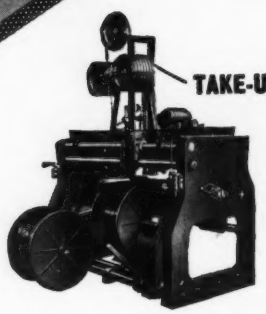

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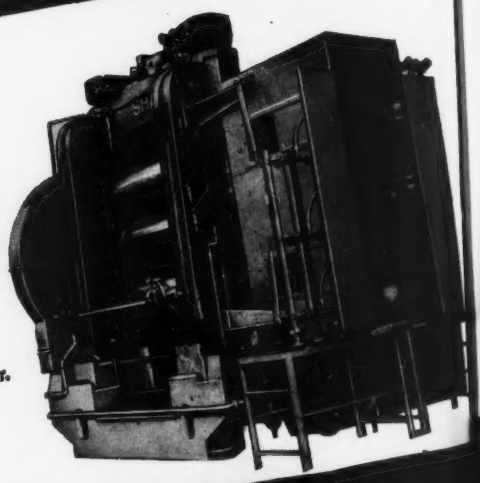

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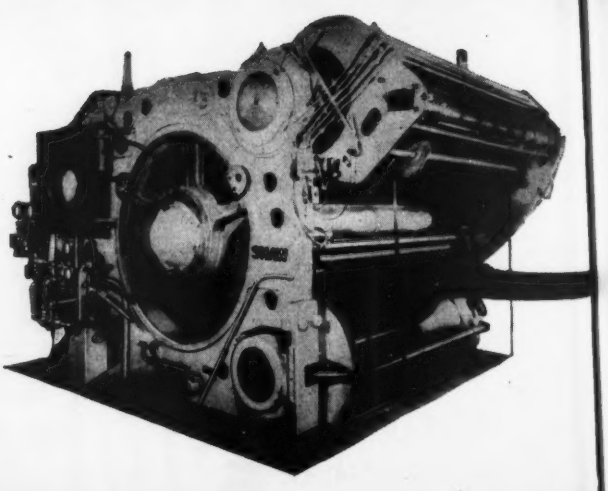
For the continuous bonding of plastics for the production of belting, flooring, matting and similar flat products.

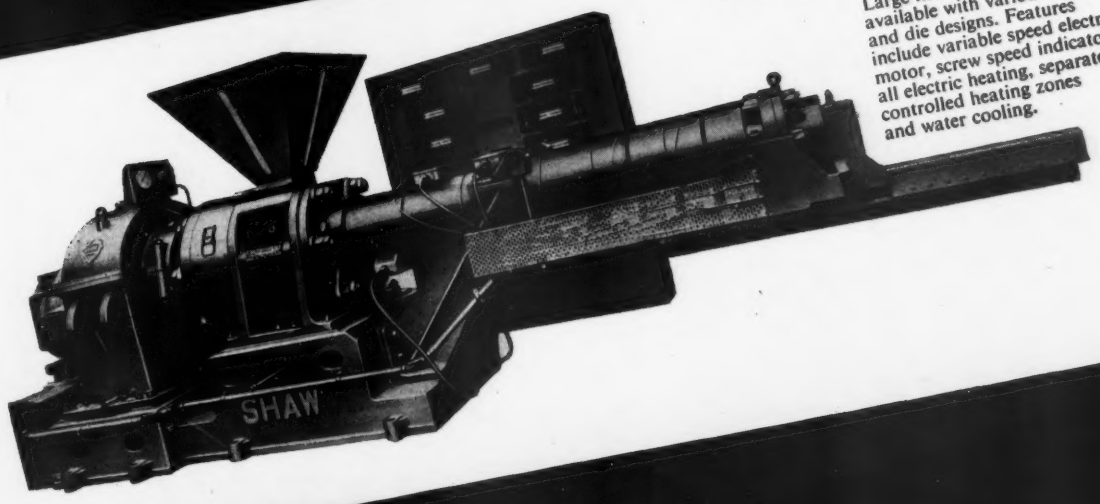


FRANCIS SHAW & CO LTD MANCHESTER 11 ENGLAND
PHONE EAST 1415/8 GRAMS CALENDER MANCHESTER TELEX 66-357
LONDON OFFICE: TERMINAL HOUSE GROSVENOR GARDENS LONDON SW1
PHONE SLOANE 0675/6 TELEX 2-2250 GRAMS VIBRATE LONDON TELEX

PLASTICS PLANT

PLASTIC EXTRUDER

Large machines of this type are available with various screw and die designs. Features include variable speed electric motor, screw speed indicator, all electric heating, separately controlled heating zones and water cooling.



from machines to complete layouts

INTERMIX

A versatile machine for compounding plastic products and a wide range of materials. Features include exclusive rotor design, anti-friction bearings, unit drive and two-speed motor.

Francis Shaw offer the experience of over 70 years and plant of the most advanced design. Our services include planning and layout of new plant or modernisation projects.

FRANCIS SHAW (CANADA) LTD GRAHAMS LANE BURLINGTON ONTARIO CANADA

TELEPHONE: NELSON 4-2350. TELEGRAMS: CALENDER BURLINGTON ONTARIO

Shape your thoughts with . .

. . DURAGLAS

Duraglas fabrics and mats are available in qualities suitable for a multiplicity of purposes and their application in the field of reinforced plastics might well prove the answer to your problem. Why not consult us ?

SEND FOR TECHNICAL LITERATURE

TURNER BROTHERS ASBESTOS CO. LTD. ROCHDALE ENGLAND

A MEMBER OF THE TURNER & NEWALL ORGANISATION

dm TA57

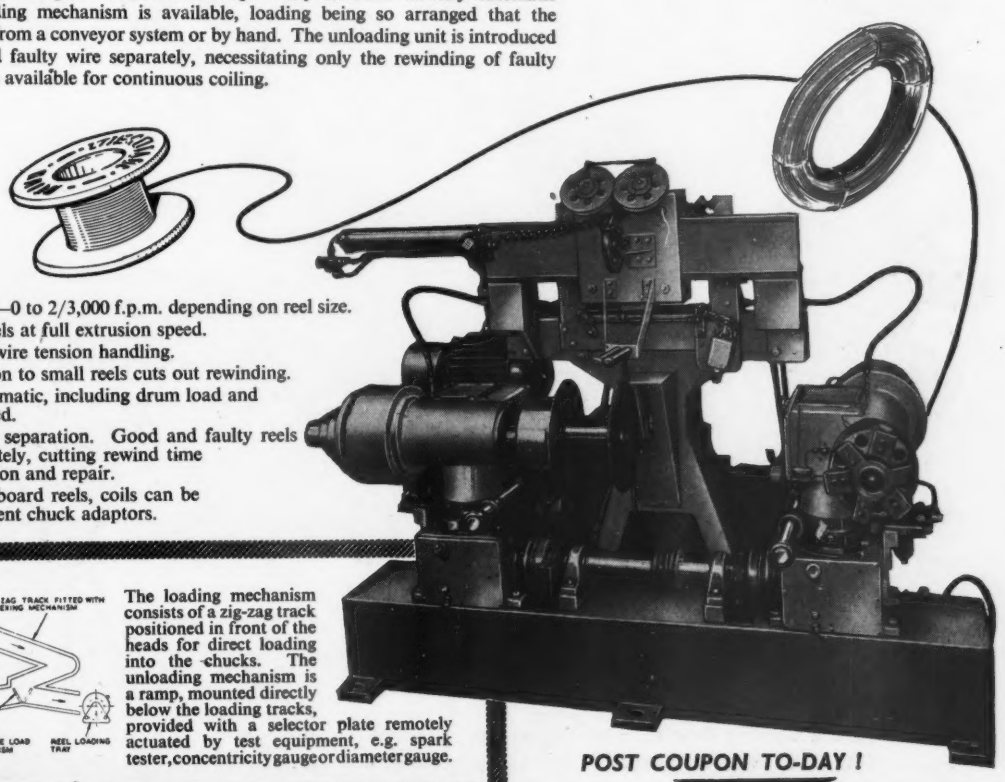
CABLE REELING REVOLUTIONISED!

NEW GENERAL TYPE TA 15 FULLY AUTOMATIC DUAL-REEL TAKE-UP

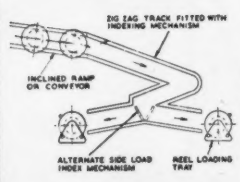
(Patents applied for in Great Britain and Countries abroad)

Here is an entirely automatic cable and wire reeling machine specially designed for reeling direct on to small diameter steel or despatch reels—entirely eliminating the operation of rewinding from large to small reels. Suitable for any continuous process, e.g. wire drawing, extruding or continuous vulcanising. 2½ lbs. operates accumulator. Reel speeds up to 2,450 r.p.m. 4:1 reel build-up readily handled. A fully automatic loading and unloading mechanism is available, loading being so arranged that the machine can be fed from a conveyor system or by hand. The unloading unit is introduced to deliver good and faulty wire separately, necessitating only the rewinding of faulty reels. Coiling heads available for continuous coiling.

★ Continuous coiling
★ Continuous winding on to despatch reels
★ Continuous winding on to machine reels



★ High wire speed—0 to 2/3,000 f.p.m. depending on reel size.
★ Wire changes reels at full extrusion speed.
★ Low controlled wire tension handling.
★ Direct winding on to small reels cuts out rewinding.
★ Completely automatic, including drum load and unload if required.
★ Automatic fault separation. Good and faulty reels delivered separately, cutting rewind time for fault relocation and repair.
★ Steel reels, cardboard reels, coils can be wound on different chuck adaptors.


ZIG ZAG TRACK FITTED WITH INDEXING MECHANISM
INCLINED RAMP OR CONVEYOR
ALTERNATE SIDE LOAD INDEX MECHANISM
REEL LOADING TRAY

The loading mechanism consists of a zig-zag track positioned in front of the heads for direct loading into the chucks. The unloading mechanism is a ramp, mounted directly below the loading tracks, provided with a selector plate remotely actuated by test equipment, e.g. spark tester, concentricity gauge or diameter gauge.

POST COUPON TO-DAY !

GENERAL ENGINEERING CO. (RADCLIFFE) LTD.

MAKERS OF COMPLETE EXTRUSION LINES AND CABLE PROCESSING PLANT

Station Works, Bury Road, Radcliffe, Lancashire, England.
Telephone: RADcliffe 2291 (3 lines). *Telegrams:* "General," Radcliffe.
London Office: 5th Floor, 6 Lambeth Road, St. George's Circus, London, S.E.1. *Midland Office:* 283 Stratford Road, Shirley, Solihull, Warwickshire. *Scottish Office:* J. C. Wylie, 15 Moray Place, Edinburgh, 3.
Represented in Australia, Austria, China, Denmark, Finland, France, Italy, Norway, Nyasaland, Poland, Rhodesias, Spain, South Africa, Sweden, U.S.A., Yugoslavia.

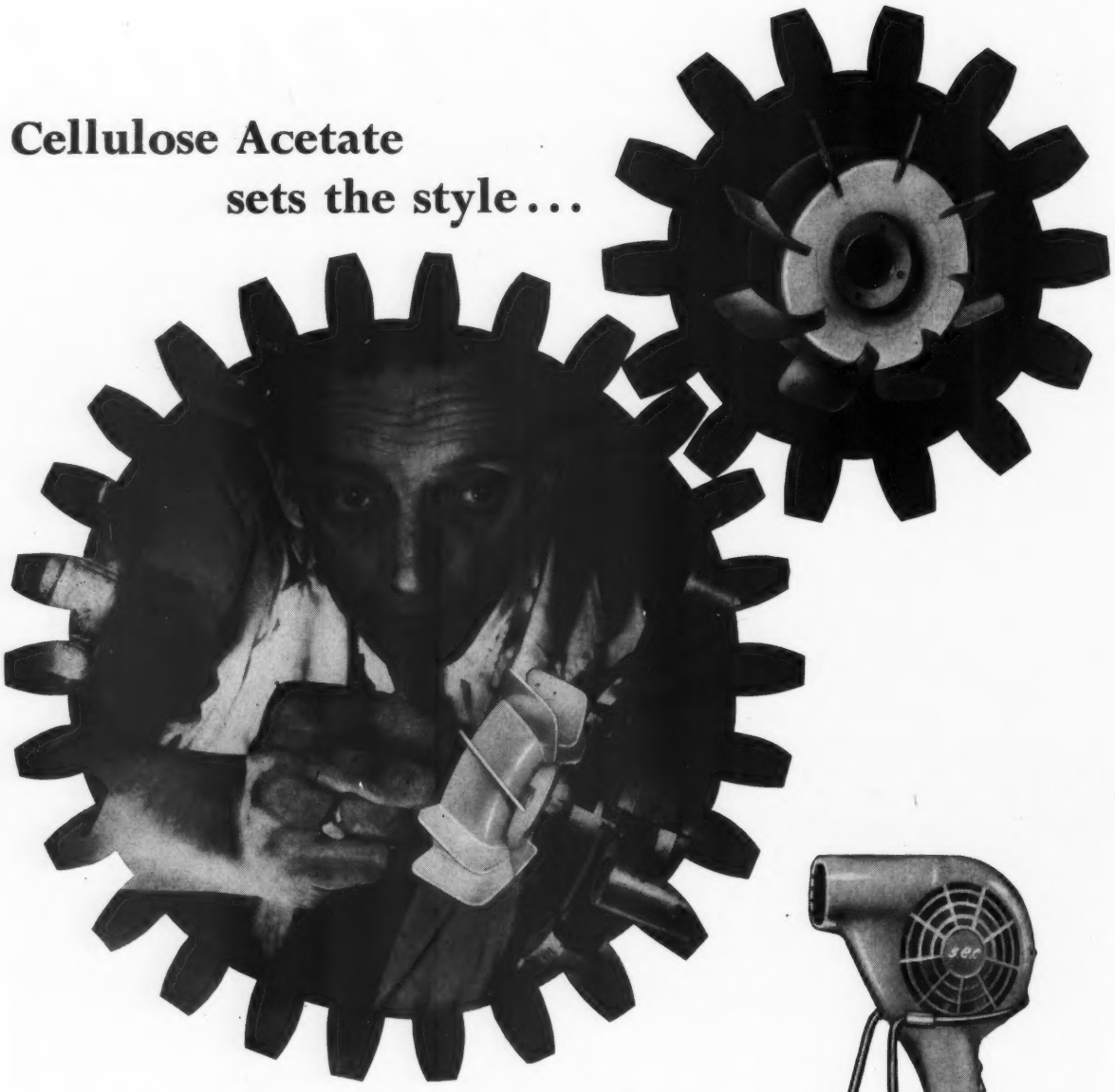
TO GENERAL ENGINEERING CO. (RADCLIFFE), LTD.
Please send Bulletin T.A.15 for Fully Automatic Patented Dual-Reel Take-up.

NAME .....

POSITION .....

FIRM .....

Cellulose Acetate sets the style...



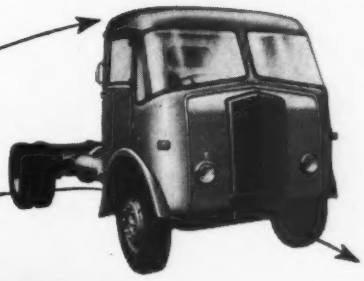
As this modern age makes increasing use of plastics in industry and the home, the G.E.C. plays an ever increasing part in adapting these materials for the diverse functions they fulfil. With experience in this sphere covering 40 years and embracing every phase of research and production, the G.E.C. is unusually well equipped to co-operate with you.

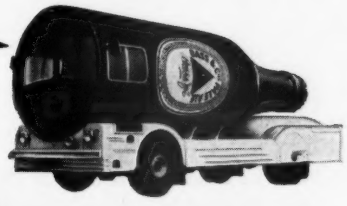
Cellulose Acetate, because of its exceptional toughness, is used for the small motor fan blades in this new hair dryer.

G.E.C.

moulded plastics for industry

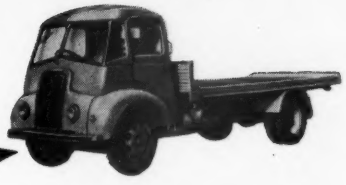
THE GENERAL ELECTRIC CO. LTD · MAGNET HOUSE, KINGSWAY, LONDON, W.C.2





The backbone of reinforced plastics for all kinds of vehicles for all kinds of reasons

FIBREGLASS
TRADE MARK



Complex sections of FRP can be moulded in one piece. FRP saves weight and it doesn't drum, dent or corrode.

1 Fibreglass Reinforced Plastic cab

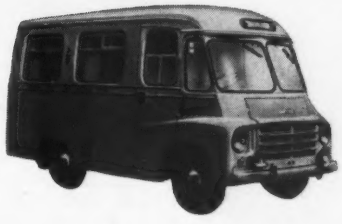
2 Fibreglass Reinforced Plastic bonnet, wings and bumper bar

3 Fibreglass Reinforced Plastic body

4 Fibreglass Reinforced Plastic cab

5 Fibreglass Reinforced Plastic front and translucent roof

6 Fibreglass Reinforced Plastic body



FIBREGLASS LIMITED, ST. HELENS, LANCS • ST. HELENS 4224

US RUBBER

Royalite

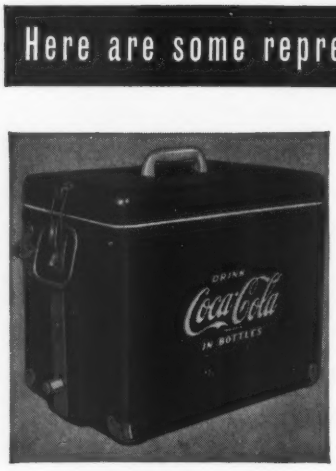
NITRILE THERMOPLASTIC SHEET

Currently in extensive use throughout the United States, ROYALITE thermoplastic sheet is now manufactured in the United Kingdom.

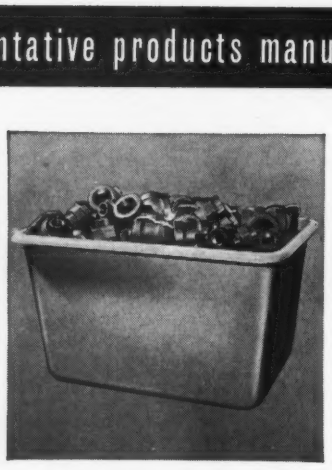
A versatile thermoplastic derived from a plastic copolymer & synthetic rubber, its remarkable properties enable it to be used in a variety of products.

"opportunities unlimited" for product designers

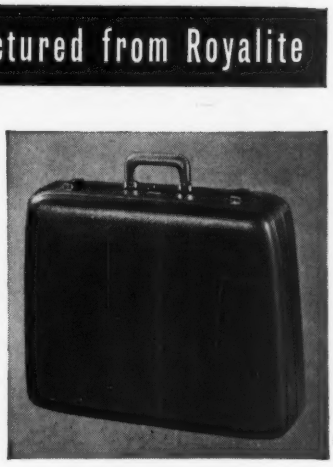
Here are some representative products manufactured from Royalite



BOTTLED DRINK COOLER

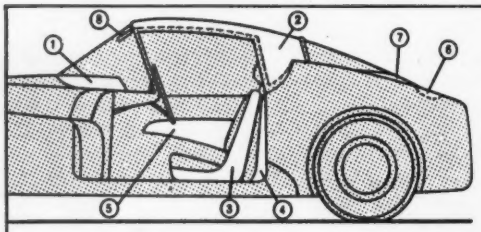


STANDARD TOTE BOX



LIGHTWEIGHT LUGGAGE

PORTABLE RADIO CASE



Body trim parts must be available in a variety of attractive colours to match modern styling, and retain their appearance through years of rough usage

1 Safety Pad (Flexible Royalite over Vibrafoam)
2 Headliner
3 Seat Trim Panel
4 Pillar Post Cover
5 Arm Rest
6 Hinge Cover
7 Rear Window Shelf
8 Sun Visor

AUTOMOTIVE PARTS

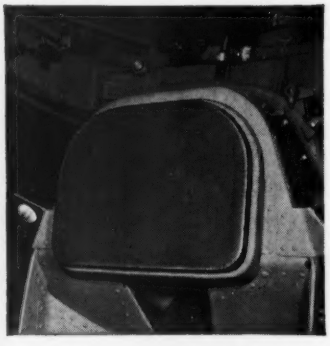
now available in Britain

Everyone benefits from

US RUBBER **Royalite**
NITRILE THERMOPLASTIC SHEET

Designers • Manufacturers • Retailers • Consumers

Electrically non-conductive — ROYALITE will not conduct electricity and is therefore especially useful in electrical applications.



AIRCRAFT CABIN TRIM

TELL-A-TOUCH TYPEWRITER

Lightweight — ROYALITE is approximately 40% the weight of aluminium and weighs considerably less than other materials to which it is equal in strength and resistance to scars and abrasions.

Flexible or Rigid — ROYALITE is supplied in both forms, according to the needs of the designer.

Chemically resistant — ROYALITE is resistant to corrosion by most acids and alkalis.

Grease-resistant — ROYALITE resists corrosion or staining by greases, oils and most solvents.

Non-magnetic — ROYALITE is therefore particularly suitable for containers such as meter cases where no distortion of a magnetic field is required. ROYALITE does not develop static charge.

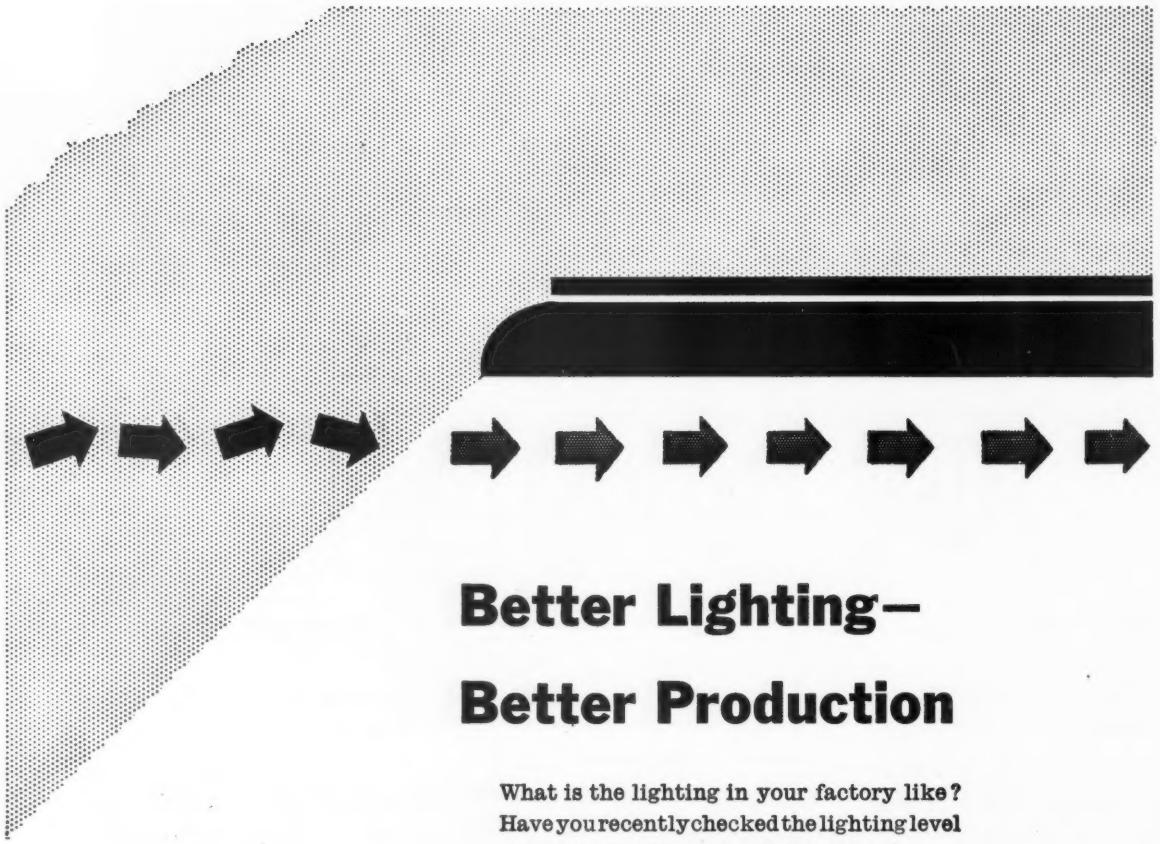
Odourless — ROYALITE has no smell and a very low moisture absorption rate which make it unique amongst materials for food storage containers.

Applications for further information invited

US RUBBER **U. S. Rubber**

Home: *The North British Rubber Company Limited. ABBey 7135*
Export: *U.S. Rubber International (Great Britain) Ltd. ABBey 2053*

62/64 HORSEFERRY ROAD, LONDON, S.W.1



Better Lighting—
Better Production

What is the lighting in your factory like? Have you recently checked the lighting level round the works with a light meter?

The *right* lighting has a significant effect on the speed and accuracy of production. When its strength, position and type is suitable for each job the craftsman can give full play to his skill, and the works engineer can do full justice to his shop.

Good lighting is only one of the many ways in which electricity is playing a vital part in the drive for higher productivity.

Electricity for Productivity

Ask your ELECTRICITY BOARD for advice and information, or get in touch with E.D.A. They can lend you, without charge, films about the uses of electricity in industry. E.D.A. are also publishing a series of books on Electricity and Productivity. Titles now available are: Lighting in Industry, Electric Resistance Heating, Electric Motors and Controls, Higher Production, Materials Handling, and the latest addition to the series, Induction and Dielectric Heating. Price 8/6, or 9/- post free.

Issued by the
British Electrical Development Association
2 Savoy Hill, London, W.C.2

Make a name for yourself in 'PERSPEX'

1 South African display sign for K Royal Tyres.

'PERSPEX' ACRYLIC SHEET makes the best signs in any language. It is a very handsome material, extremely tough, light and easy to handle, and will stand up to weather conditions in any part of the world.

The advertising display signs illustrated are Italian, South African and British. 'Perspex' is selling goods all over the world, every minute of the day—and often far into the night. Because 'Perspex' can be transparent, it is ideal for illuminated displays.

'Perspex' is available in clear or opal sheet or in a wide range of transparent, translucent and opaque colours.

2 Irish 'Perspex' sign for 'Esso' Petrol, made by Ideal Manufacturing Co. Ltd., Dublin

3 Italian illuminated sign for S. Pellegrino orangeade, made of 'Perspex'.

'PERSPEX' *is the registered trade mark for the acrylic sheet manufactured by I.C.I.*

ICI

P.627

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

C

Nash

★ ★ Base papers for plastics ★ ★

WILLIAM NASH LIMITED

have made Fine Papers for over 100 years and during the present century have developed qualities for technical and industrial uses. Base Paper for the Plastic Industry is now a regular product at Cray Valley Paper Mills and its manufacture is under the supervision of specially trained technicians to ensure regularity of quality. All enquiries for this type of paper will receive most careful attention and individual specifications can be closely followed.

CRAY VALLEY PAPER MILLS

ST. PAULS CRAY · ORPINGTON · KENT

● *This Refrigerator Liner, made from ·125" thickness SAROY, measures 19½" x 33½" x 12¾" deep.*

STRUCTURAL PLASTICS

FIND THEIR FORM

in Modern Coachbuilding

—with BAKELITE Polyester Resins

TRADE MARK

The 'Easi-Access' cab on the B.M.C. forward control lorry illustrated above is moulded by King & Taylor Ltd. from BAKELITE *Polyester Resins reinforced with glass fibre.*

This tough, light-weight cab is now being used on B.M.C. vehicles of 3, 4, 5 and 7 tons. A big saving in tare has been achieved and this feature, combined with high impact strength, great ease and economy of panel repair work, is a major advantage of the cab's economical operation. BAKELITE Polyester Resin/glass fibre bodywork like this can be produced without expensive capital equipment. Mouldings may be self-coloured or finished in the normal way, and are not subject to rust or any of the forms of corrosion associated with metals.

Write or 'phone for advice and further details.

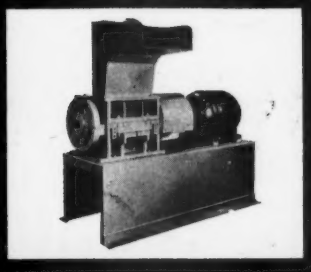
BAKELITE LIMITED

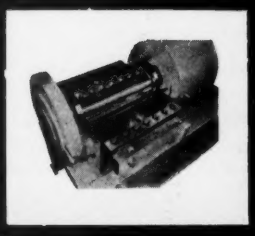
REGD.

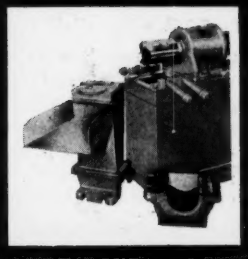
12-18 GROSVENOR GARDENS · LONDON SW1 · SLOane 0898

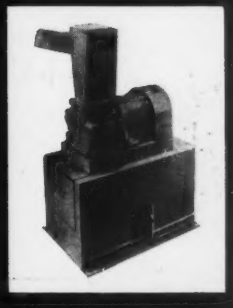
Bakelite Limited manufacture an extensive range of plastics materials and maintain a technical service unequalled in the industry. No matter what your plastics problems, this service is at your disposal. SLOane 0898 is the telephone number.

TGA RP13

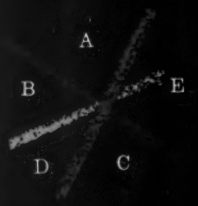








BURTONWOOD/CUMBERLAND PLASTICS GRANULATING MACHINES



Burtonwood Engineering Company now manufacture a complete range of Plastics Granulating Machines. Top or side feed models are available which will reduce large pieces of Mill Head, waste and Mill rejects.

. MODEL 20 GRANULATOR Capable of the heaviest work, capacity 600-700 lbs. per hour. All steel construction, high carbon, high chrome knives.

. DISMANTLED VIEW of the MODEL 20 Cutting Head, illustrating accessibility for cleaning and for obtaining accurate knife settings

C. MODEL ½ Burtonwood Cumberland — V Belt driven machines have been specially designed to be used next to individual injection moulding machines. A slower speed and lower horsepower are ideally suited for this application, where the machine must run continuously. Each machine contains a built-in dirt-proof material bin in its base.

. DISMANTLED VIEW MODEL ½ The dismantled view shows ease and rapidity with which the machine may be dismantled and cleaned.

. MODEL 0 For use in conjunction with injection moulding and extrusion machines. Mobile, bench, or floor mounting types available.

BURTONWOOD ENGINEERING CO. LTD.

BURTONWOOD, WARRINGTON, LANCASHIRE. Telephone: Newton-le-Willows 3331 (10 lines)
London Office & Works: EDGWARE ROAD, THE HYDE, LONDON, N.W.9. Telephone: Colindale 4661 (7 lines)

Cap—cut away to show Polythene seal which makes the case airtight.

Problem case solved!

AMONG THE HOST of items which a woman keeps in her handbag, you will usually find solidified cologne or lavender. Look at the case and you will probably find the name DEMUTH, whose FROZOCLONE and FROZOLAVENDER were the first in the world, and are still the only products with added soothing, cooling, and comforting properties —ideal for the relief of headaches and the tensions of everyday life. Naturally, the unique merit of these products demanded a high class container.

Some time ago, R. Demuth Ltd. discussed with Fraser and Glass the possibility of streamlining and making their existing container more attractive.

One of the chief problems was how to produce a vapour-tight case and so avoid deterioration of the product during storage. Previously, a rubber ring had been used for this purpose. Fraser and Glass not only designed a new and more attractive case, but also evolved a special Polythene seal which was permanently held in position in the cap. This provided a positive airtight seal.

All that remained was the problem of mass production. Three special automatic moulds were designed to produce the base, screw-on lid, and seal, in such a way that no subsequent finishing was required. A special automatic unscrewing mould was devised for the cap, effecting a considerable saving in normal production costs.

The finished container in green or lavender Polystyrene is now being economically produced in large numbers every week, meeting completely, the specifications required. Just another example of the skill and service which Fraser and Glass can offer to industry.

If you have a moulding problem in your *industry— no doubt Fraser & Glass can supply the answer.*

Another problem solved by

FRASER & GLASS

the plastics people

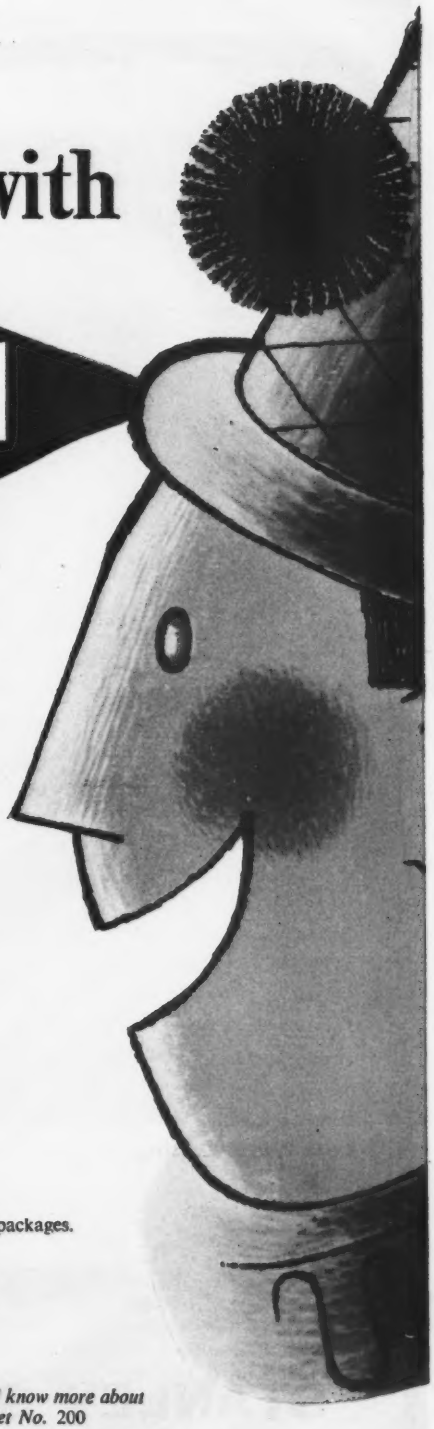
FRASER & GLASS LTD.,
WOODSIDE LANE, LONDON, N.12
TELEPHONE: HILLSIDE 2224-5

Christmas Greetings
And Best Wishes
For The
New Year
to all our customer friends
From

Good mornings
begin with Gillette . . . .
HEAVY
MEDIUM
LIGHT
Superspeed Trio
Gillette

Better packages with

STYRON
Polystyrene



The smooth finish of tempered steel and the clean good looks of Styron Polystyrene combine to make a selling success of Gillette's new Superspeed Trio. Unsurpassed in performance as a packaging material, Styron possesses the perfect crystal clarity and remarkable range of colours to attract the eye and stimulate a purchase. With its other clear cut advantages of strength, lightness, ease of fabrication and hygiene, Styron gives to all manufacturers the promise of *profitable packaging* with the most versatile form of polystyrene.

as well as see-through appeal

STYRON OFFERS

COSMETICS	durability; crystal clear or opaque; virtually unlimited colour and design.
FANCY GOODS	colour! colour! colour! 60 standard colours and 3,000 shades.
TEXTILES	toughness; design versatility in moulded or formed packages.
FROZEN FOODS	rigidity at low temperatures; cheaper than fibre; non-absorbent.
PRESERVES	lightness; strength; does not chip or shatter; takes clear brand marking.
SOFT FRUIT VEGETABLES	hygiene, non-toxicity; does not crush or chip.

BRP

Whether or not your product is in this list you should know more about the advantages of Styron packaging. Write for Booklet No. 200

Sole Selling Agents **BRITISH RESIN PRODUCTS LTD**

SALES AND TECHNICAL SERVICE DEVONSHIRE HOUSE PICCADILLY LONDON W1 MAYfair 8867

Manufactured by Distrene Limited · Distrene Limited are registered users of the trade mark 'Styron'

'VITRONE'
P.V.C.

'VITRONE'
Rigid & Flexible
Continuous Film,
Plastic/Metal Laminates,
Pressed Sheets including
Opal, Glass Clear and
Non-Toxic Grades,
Petrol Resistant Grades.
Extrusions,
Clear non-toxic tubing,
Petrol Resistant Grades.

'VITRATHENE'
POLYTHENE

'VITRATHENE'
Sheets, Rods,
Tubes & Blocks,
Extrusions,
Cold Water Tubing.

STANLEY SMITH & COMPANY

WORPLE ROAD • ISLEWORTH • MIDDX • HOUNSLOW 3406

TELEGRAMS: STANMITH • PHONE: LONDON

Aeroplastics tooled-up and made many components for the Fairey Delta 2, holder of the World Air Speed Record.

the fastest

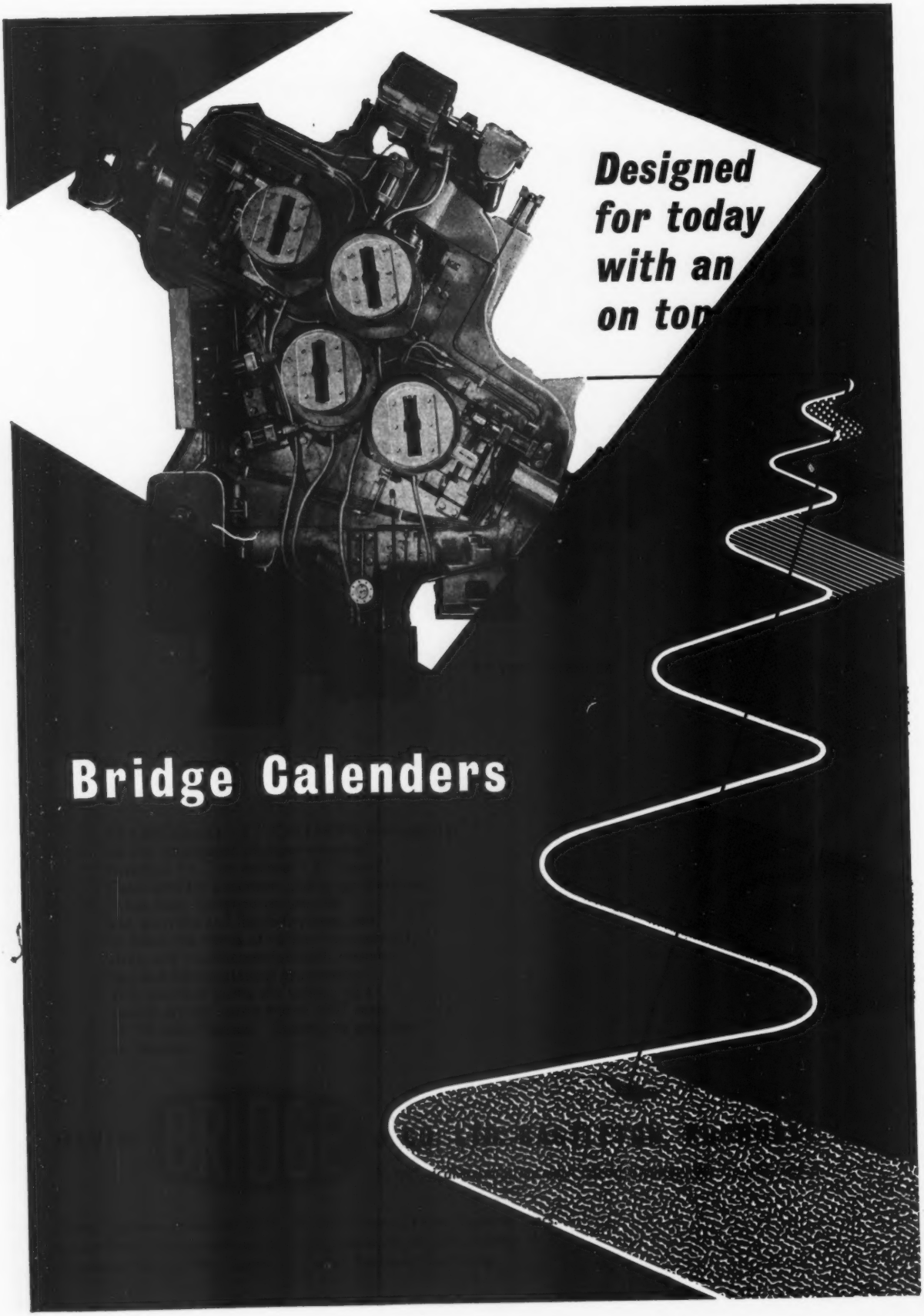
way to get something done with plastics is to come and talk to Aeroplastics about it. If it can be done, Aeroplastics can do it—almost certainly *have* done it. Research and special developments for the aircraft industry have created a knowledge of moulding and fabrication techniques whose equal may be hard to find elsewhere.

Aeroplastics have capacity for long or short-run production in any material, by any method; compression or injection moulding, fabrication, impregnation, glass fibre/polyester products, tool design and manufacture: and for any aspect of production or development in plastics where breadth of experience and ample facilities are needed.

AEROPLASTICS LIMITED

HILLINGTON · GLASGOW

A subsidiary of The Fairey Aviation Co. Ltd.


Designed
for today
with an
on ton
Bridge Calenders

Littondale is one of Yorkshire's famous beauty spots and our photograph shows Bridge End House at Arncliffe, one of the loveliest old houses in the Dale. It was here, in the 19th Century, that Charles Kingsley, Clergyman and Novelist wrote part of his famous book the "Water Babies". The sentiment of goodwill to all which Kingsley expressed through the characters in his story has prompted us to choose his home to illustrate our

Christmas Greetings

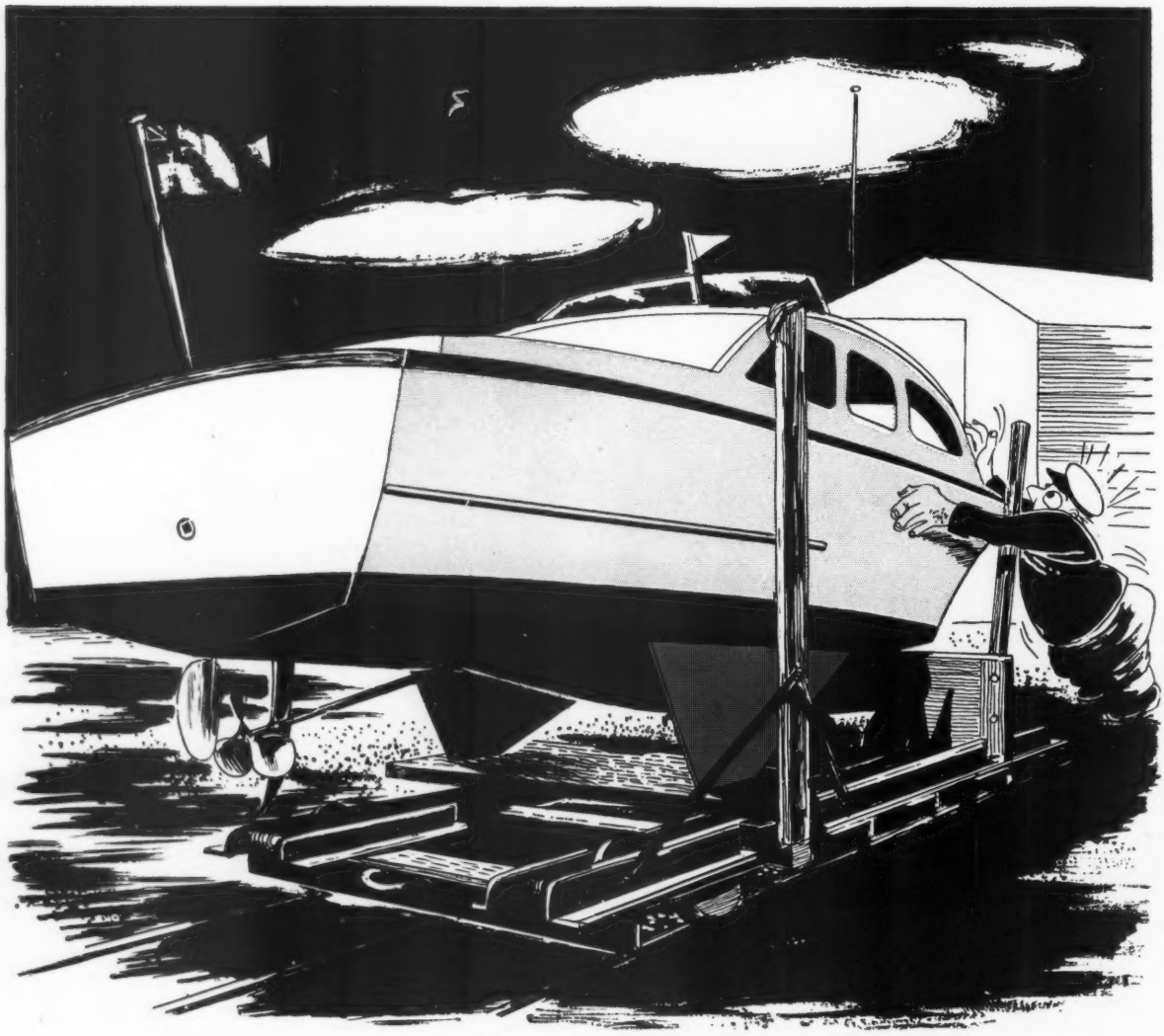
from Directors and Staff to friends throughout the world

Birkbys Ltd

LIVERSEDGE, YORKSHIRE

PLASTICS ELO PRODUCTS

London Office: 79, BAKER STREET, W.1.



Can't you push the boat out?

Maybe you need a reliable mould-release agent—in the low pressure moulding of plastics, especially glass fibre reinforced polyester resins, polyvinyl alcohol films will be useful to you as a separator, parting agent, laying-up blanket, or for bag moulding.

'Pevalon' and 'Rhodoviol' films are supplied in various grades and thicknesses. Special qualities are available for water-soluble and chemical-resistant packages. May we send you further information?

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trade mark

'RHODOVIOL'
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Imparting information to grandma is a notably unprofitable occupation—and telling people who already know about the uses of formaldehyde is equally time-wasting.

But we would like you to know that we—the *first* U.K. producers—offer quick delivery of high standard water white formaldehyde in any quantity, anywhere. Our service is constant and quality consistent.

If you are interested, write for our new booklet which gives complete specifications of Ashworth formaldehyde and useful information about its handling and storage.

And, if you need urgent deliveries or technical advice—

Phone BURY 51 for ASHWORTH

Formaldehyde

Also paraformaldehyde and hexamine

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Curing range for Resin Bonded Asbestos products.
Photo by courtesy of Ferodo Ltd.

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FOR THE PLASTICS INDUSTRY

In solving heat treatment problems—from setting nylon to fusing conveyor belting—SPOONERS have been outstandingly successful. Our technical staff will advise on your individual needs.

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★ Available in a variety of hardnesses and a wide range of bright colours

★ Durable; tough and strong

★ Resistant to corrosion

★ Odourless, tasteless, non-toxic

★ Pleasant to the touch

★ Non-flam material available

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D

"Well, it certainly sounds all right"

Exactly, and that is our problem. Because, described in words, any temperature controller can look *good, can* appear *to be exactly what you need, can* seem *to offer that degree of control vital to accurate and consistent extrusion or moulding. And certainly they can be* said *to be very reliable.*

BUT CAN WE PROVE IT?

Now we sincerely believe that the combination of qualities offered by our instruments — accuracy of control within fine tolerances, simplicity of fitting and removing the control unit, compact, sturdy construction — add up to a more efficient, more reliable, and more economical instrument. But having *said* all that we are left with the problem of *demonstrating* that a West Instrument really is the best one for use on your specific moulders or extruders.

OUR SIXTY-DAYS SALES DEMONSTRATION

Our method of working has arisen from this problem. First, we give you full facts about the instrument. Then we answer your technical queries. Finally — if you wish — we install, quite without charge, the appropriate West Instrument on one of your machines. We leave it installed and working for sixty days. Then we come back and talk to you again.

If this seems reasonable to you and you would like to know more about West Instruments and the service we offer, please write to us, giving the fullest possible details about your specific needs. Our Technical Service Department will be pleased to help you.

JP PROPORTIONING TYPE CONTROLLER, shown here, works within very fine tolerances, corrects for thermal inertia, does not overshoot control points. All components under-run for reliability. No thermionic valves; extremely robust. No transistors; unaffected by ambient temperatures. Control unit simply unplugs for service or replacement.

WEST *Instrument* **LIMITED**

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PROPERTIES of DMC MOULDINGS

EXCELLENT MECHANICAL STRENGTH
HIGH IMPACT STRENGTH
DIMENSIONAL STABILITY
TEMPERATURE RESISTANCE
GOOD DIELECTRIC STRENGTH
RESISTANCE TO TRACKING
LOW WATER ABSORPTION
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DMC* mouldings

(POLYESTER/GLASS FIBRE)

for high mechanical and electrical strength at economical cost

All the mechanical/electrical advantages of polyester/glass fibre are yours to exploit—with the added virtue of economy. *Dough Moulding Compound is the new material that speeds and simplifies moulding because it needs only low pressures and short cure times in conventional compression presses. The proportions of resin, fibre and filler can be varied to emphasise desired properties, according to applicational need, or for cost advantages. STREETLY technicians have thoroughly investigated the characteristics and mould behaviour of all the reasonable permutations of this versatile material; production runs have provided first-hand practical experience. We are therefore in an unrivalled position to supply large numbers of DMC mouldings, produced in automatically controlled BIPEL presses with the exactitude for which STREETLY is so well-known.

Kelvinator refrigerator door latch moulding. DMC material imparts high mechanical strength throughout and excellent resistance to extremes of temperature. Moulded by the Streetly Manufacturing Co. Ltd., for Kelvinator Limited, Crewe.

ESTABLISHED APPLICATIONS

Transport

Car and bus heater housings, air ducts, fan blades, seat bases and sides, armrest foundations, door panels, window strips

Electrical

Stand-off insulators, coil forms, brush holder insulators, support blocks, switch boxes and covers, circuit breaker bases, battery housings

Domestic

Washing machine impellers, spin dryers, refrigerator parts, suction cleaner parts, furniture handles, door handles, sports goods

DMC for strength — **STREETLY** for **DMC** mouldings

THE STREETLY MANUFACTURING CO. LTD · STREETLY WORKS · SUTTON COLDFIELD · TELEPHONE: STREETLY 2411

Fielden AUTOMATION

Precision T

On/Off control action on a Temperature Differential of ±0·1°C.

This instrument gives improved, simplified, and economical temperature control with long term calibration accuracy for both industrial and laboratory applications.

This instrument has a switching differential as low as 0·1°C at temperature ranges up to 100°C and ±0·1% of the range span for spans of more than 100°C. Amber and green pilot lamps indicate when the temperature at the point of measurement is above or below the temperature set on the scale and a bell or buzzer can be connected to give audible warnings. Robust two-way contacts within the instrument are used to control electrical heating or cooling, or can be connected to a solenoid valve to control steam or oil heating supplies, or water or air cooling systems.

Instruments are available for any range between minus 200°C and plus 500°C. Both centigrade and fahrenheit calibrations are available, the minimum scale range being 10°C or 20°F. The installation of the instrument requires no special knowledge.

Ranges

Standard ranges are:

−50° to + 50°C	0 to 200°C
0 to 100°C	0 to 500°C
0 to 120°C	100° to 500°C

To special order.

Non-standard Centigrade scale or Fahrenheit scales can be provided with a minimum temperature range of 10° C or 20° F.

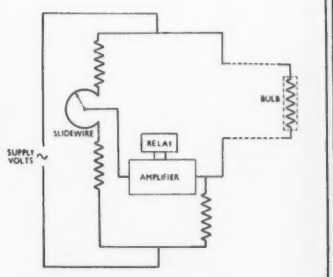
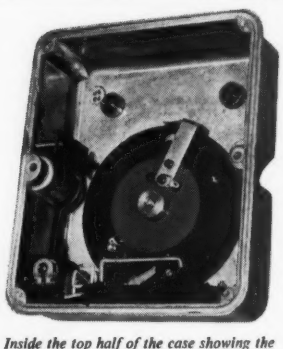


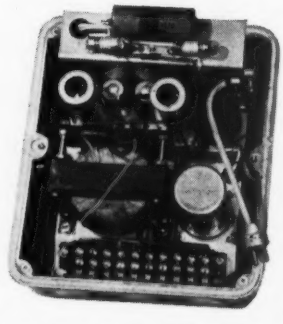
Fig. 1
Schematic diagram of Fielden Electronic Precision Temperature Controller.

Principle of Operation

An alternating voltage is applied to the bridge and the out of balance voltage is amplified by a high gain, phase sensitive amplifier, the output from which operates a relay (see fig 1.) Its lasting accuracy depends solely on the stability of the resistances which form the bridge, and these have been specially selected to remain stable under varying conditions over long periods of time.



Inside the top half of the case showing the slide wire and contact actuated by the calibrated dial on the front.



Inside view of Temperature Controller showing the compactness of the internal arrangement.

Temperature Controller

Flameproof Model

This controller is housed in a flameproof enclosure covered by Ministry of Fuel and Power Certificate No. FLP 3521 H/S 5540/762 for group II and III gases. The resistance bulb and leads thereto are covered by Intrinsically Safe Certificate IS 3014 for the Hydrogen and Pentane groups.

Bulbs

The resistance elements used are manufactured to close tolerances and are interchangeable without re-calibration. Two forms are available, the form 4 with plug and socket connection and the form 11 for use with terminating heads, in a number of lengths from 6" to 36". For many applications the bulbs can be used without pockets, enabling full advantage to be taken of their very rapid response.

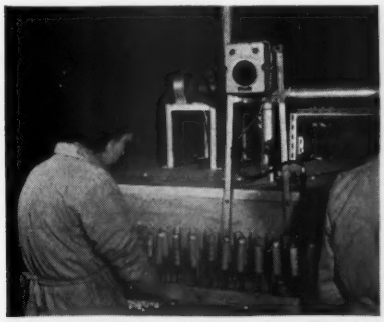
SOME APPLICATIONS

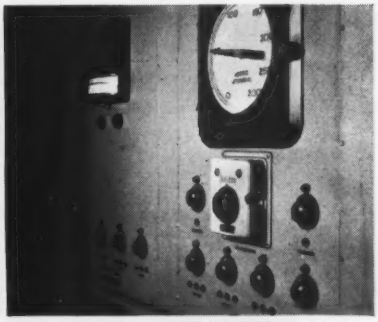
ON ELECTRICALLY HEATED OVENS

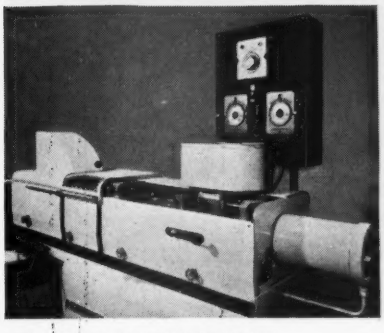
Controlling electrically heated drying ovens for extruded metal tubes at the Flexile Metal Co. Ltd.

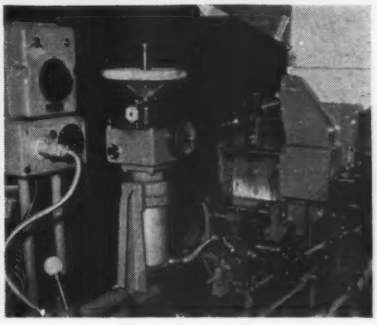
IN THE CHEMICAL INDUSTRY

On a distillation plant at Messrs. Y. B. Bavon Ltd. Used in purifying a compound for waterproofing leather.









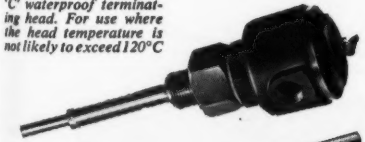
ON RUBBER & PLASTICS PLANT

On a nylon injection moulding machine where the temperature of the nozzle is controlled – at Messrs. Nettle Accessories Ltd.

ON SPECIAL PURPOSE MACHINERY

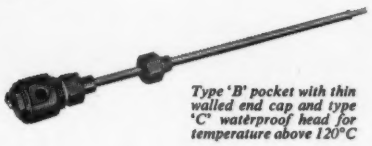
Fitted on a Molins filter tip cigarette machine to seal the paper wrapped round filters and cigarettes.

Type 'A' pocket with thin walled end cap and type 'C' waterproof terminating head. For use where the head temperature is not likely to exceed 120°C



Lightweight Head with form 11 resistance bulb.

Form 11 resistance bulb with type 'C' waterproof head.



Type 'B' pocket with thin walled end cap and type 'C' waterproof head for temperature above 120°C

Terminating Heads and Pockets

Waterproof terminating heads in aluminium, cast-iron, phosphor bronze, or stainless steel give complete protection for form 11 bulbs, providing conduit cable entry for two or three-wire systems; an inexpensive lightweight head is also available.

The pockets illustrated cover most installations and where thermal lag is important, can be fitted with a special thin end-cap.

Fielden

For further information write for leaflet 219/P

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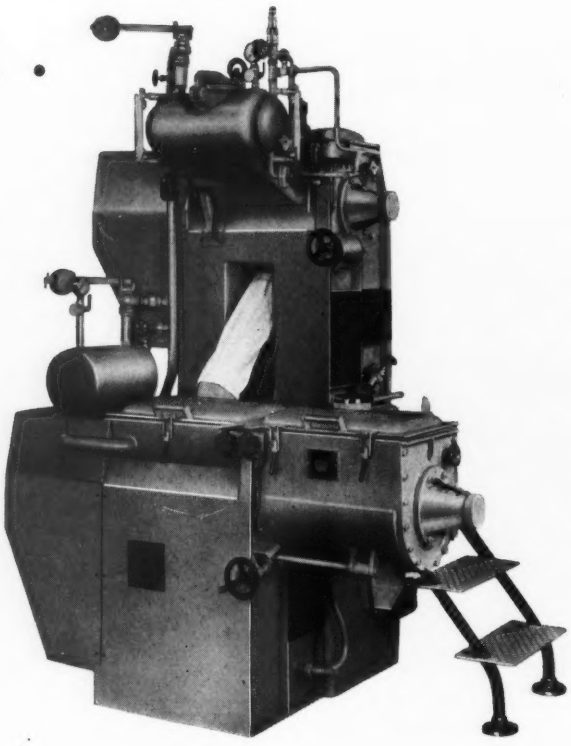
machinery from IPL



The Pastorello

Continuous Pre-Mixer

FROM BATCH
TO CONTINUOUS FEED
IN ONE MACHINE

Pre-mixes, gells, colours, and continuously feeds PVC emulsion and suspension polymers, Polystyrene, Cellulose Acetate, Nylon, Polyethylene, etc.

The IPL Pastorello range includes single and twin barrel machines.

The DR.C. series of Pre-Mixers extends from :

Charge: 50-1,500 lbs.

Hourly output: 70-4,500 lbs.

The range of machinery from IPL includes:

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Pourtier Spark Testers
Fluidflow Screener Conveyors
Condux Granulators
Eck Mixtruders
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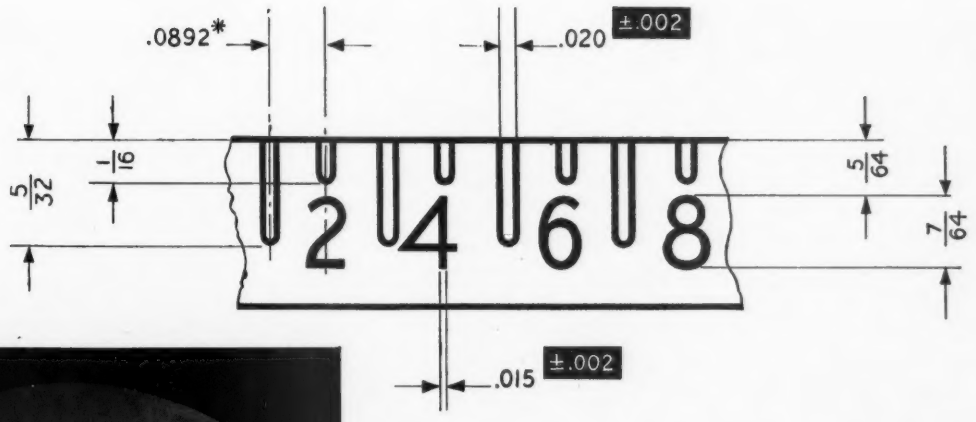
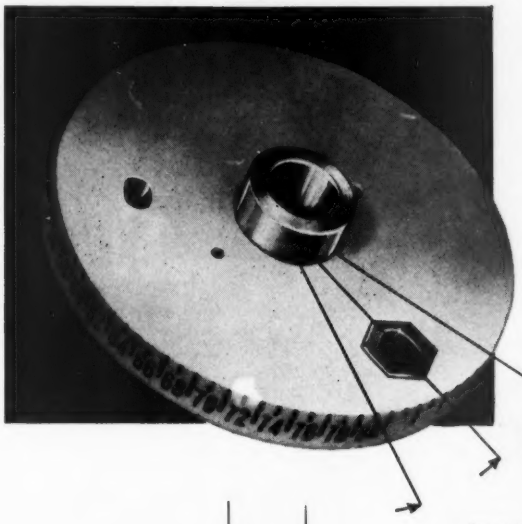
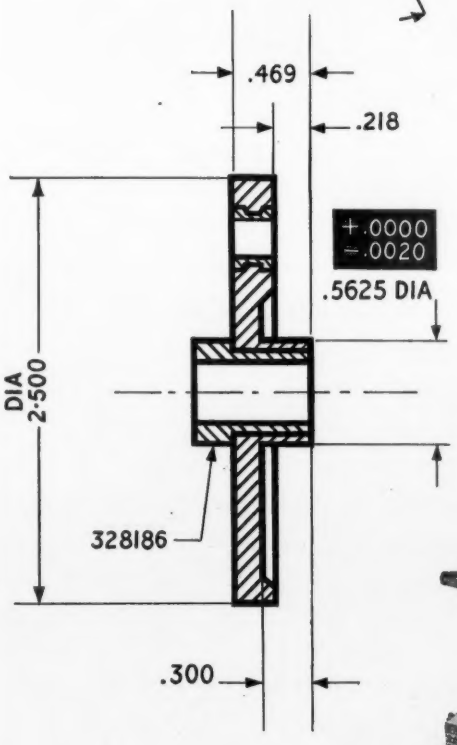




precision

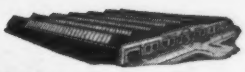
If at first sight this moulding appears to be simple—look again. Look at those tolerances. As you can see the job was moulded around two metal inserts in high impact polystyrene. Note the relation between the centre line of the metal inserts and the numbers and graduations. The tolerance permitted was only ± 0° 15′. The numbers and graduations are interesting. They were recessed to 0.008 in. and subsequently filled in with black enamel specially selected for use with polystyrene. They created quite a problem in tool design and ejection as on the tools they were in relief. We take difficult jobs in our stride. Why not let us quote for your next moulding? Illustrations by kind permission of International Business Machines (U.K.) Ltd.



E. Elliott Limited

The Plastic moulders with the Engineering background

Victoria Works (Summer Lane)



Walsall Works (Bescot Crescent)

Walsall Works (Eldon Street)

Cheapside Works

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with true intent...

In few businesses, perhaps, is the art of the individual so important as in toolmaking. Whilst there are many aspects, such as machinery, material quality, etc., which contribute to create the product, the skill of the operator is the vital factor. Only a long and thorough training under careful supervision can develop the unvarying standard of operational skill expected of The Craftsmen of Tyburn Road. We provide all the facilities under ideal working conditions for this slow—but sure—transition, and we are especially fortunate in being able to draw our workers from an area steeped in the metalworking traditions.

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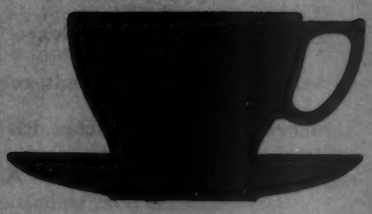
Melamine in paint
makes a better finish.

Marvellous Melamine!



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moulding powders
for to-day's tableware.

Melamine crystals

British Oxygen Chemicals supply Melamine to makers of resins and moulding powders for—

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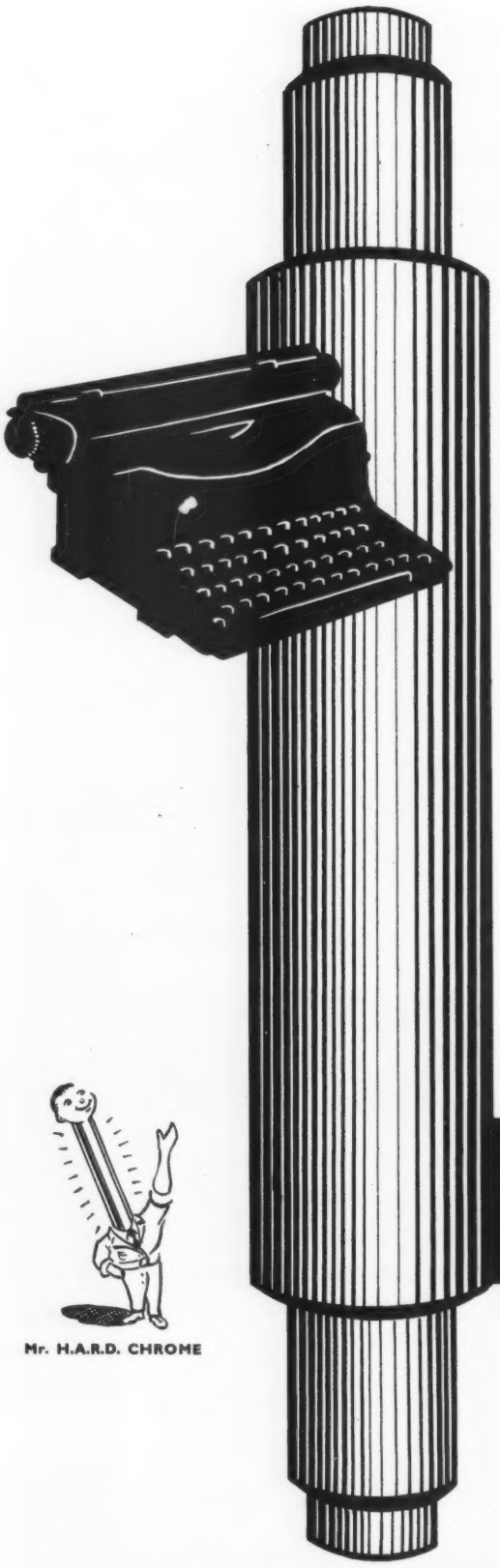

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● *Leading Moulders use*

Sternite

MOULDING POWDER

The " Thermovent " heater panel moulded in Sternite phenolic material is illustrated by courtesy of EKCO PLASTICS LTD. The material selected for this highly critical moulding, demanding excellent finish, very good mechanical strength, resistance to heat over prolonged periods, and consistent shrinkage, is Sternite grade SPF. 41—a super quality grade from the range of Sternite special " cabinet " grades.

Sterling Moulding Materials Limited

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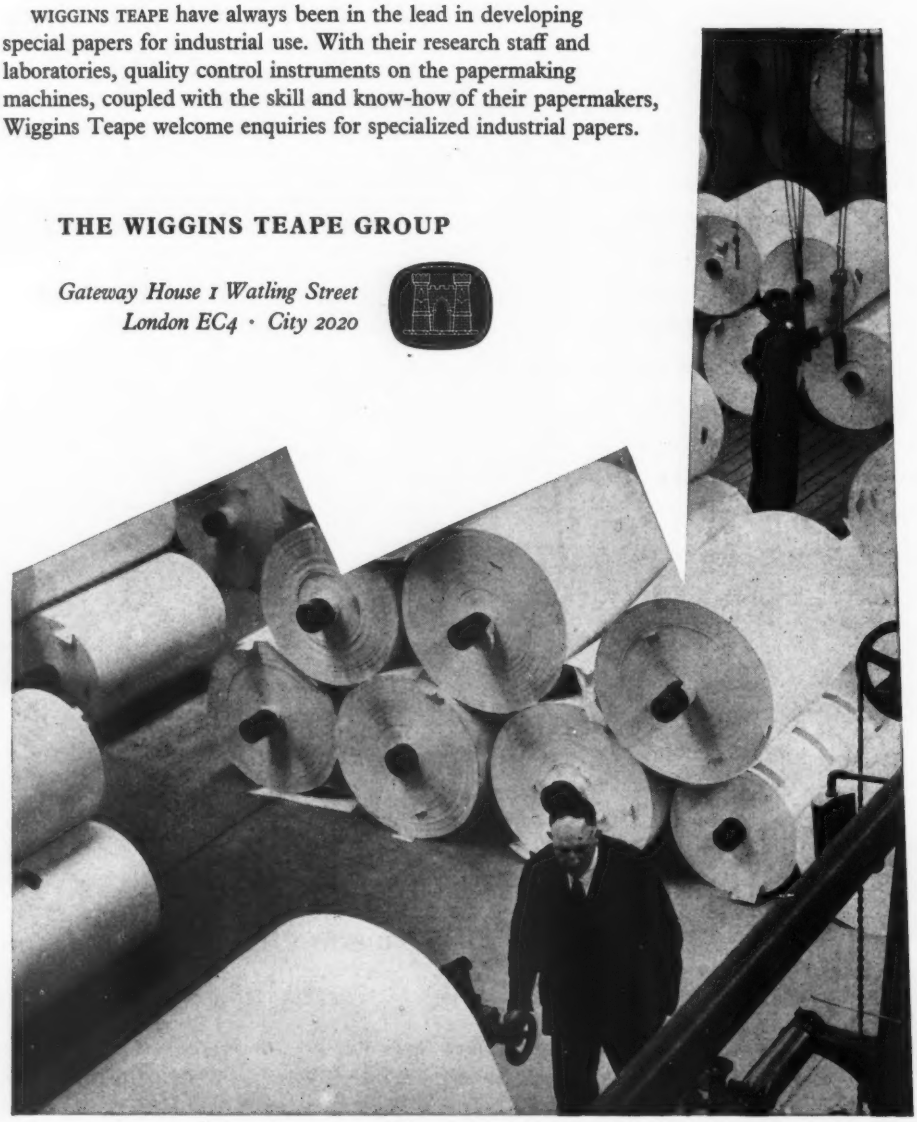
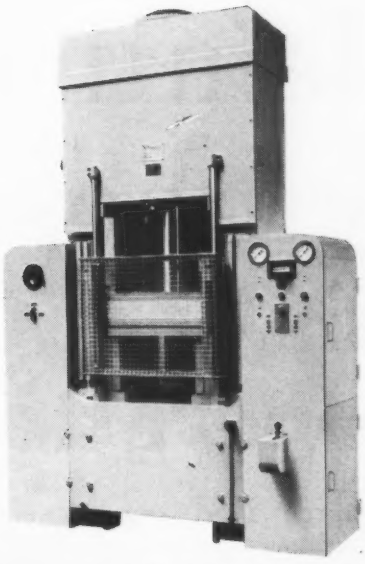
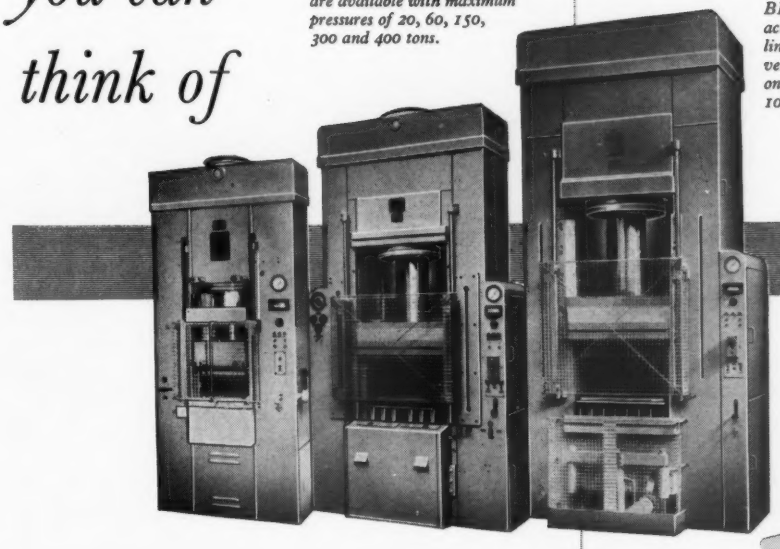


BIPEL MAKE *every kind of* compression press *you can think of*

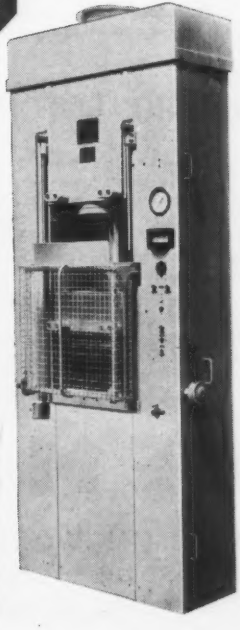


BIPEL 150-ton double-acting side ram press. With line feed. Maximum load on vertical movement is 150 tons, on horizontal movement 100 tons.

BIPEL auto-control presses are available with maximum pressures of 20, 60, 150, 300 and 400 tons.



BIPEL 20-ton Alkyd Moulding Press. Specially designed for Alkyd moulding, this press has a very quick cycle time. It operates at a working pressure of 20 tons on a 14 in. stroke.



Most modern, most efficient, most economical—that in a nutshell describes BIPEL, the only ***complete system*** of hydraulic moulding available in this country. These clean-looking presses with all line services fed underground revolutionise shop layout, vastly increase productivity, appreciably reduce overheads. Essentially adaptable, dual-purpose variations on basic models are available for compression/transfer, and compression/injection moulding; all types incorporate auto-control of the moulding cycle, there is a fully automatic model and any model will be adapted to suit your special needs.

With individual or central drive units and a complete range of productive pelleters, ***only BIPEL***—designed by moulders for moulders—***can give you this essential flexibility.***

The **BIPEL** *system of hydraulic moulding*

B.I.P. ENGINEERING LTD., Streetly Works, Sutton Coldfield. *Telephone:* Streetly 2411.

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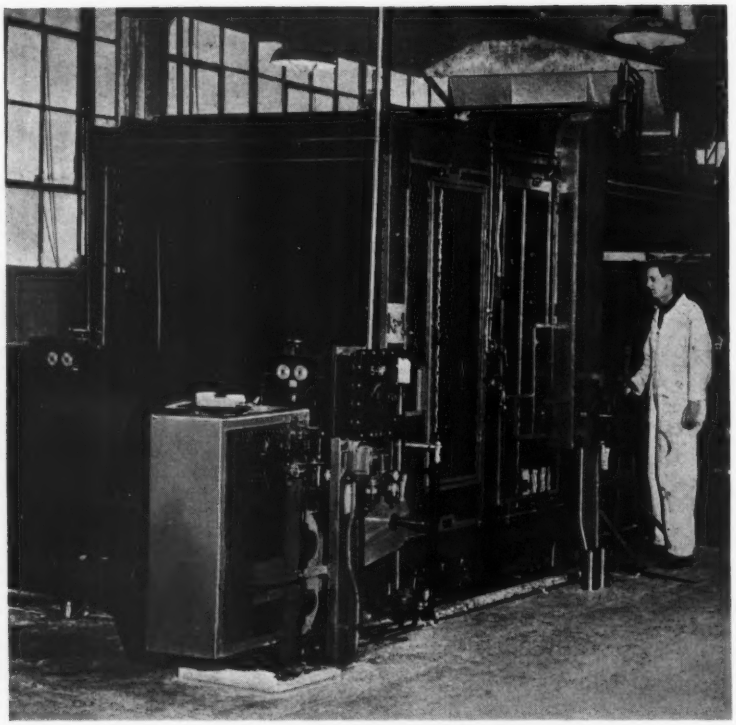
laminates embosses and prints

in one operation



LEMBO LAMINATOR-EMBOSSER performs these 3 functions on all plastic film . . .

1 LAMINATES
stretch back or drills
*without adhesives!**

2 EMBOSSES

3 VALLEY PRINTS
to closest tolerances

Compact, and costing only a fraction of mammoth equipment usually performing these jobs, it is especially practical for both short or long runs.

If your operation can benefit by fast, flexible equipment at considerably lower outlay and upkeep, you're invited to see the new LEMBO LAMINATOR-EMBOSSER in action. We will be happy to make experimental runs for you.

*Subject to proper film formulation and gauge.

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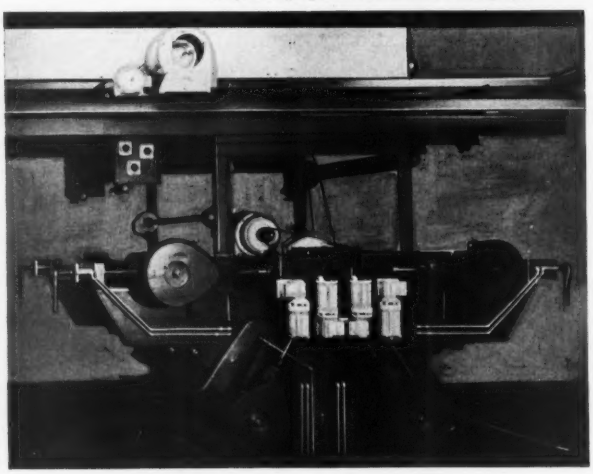

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Plastics

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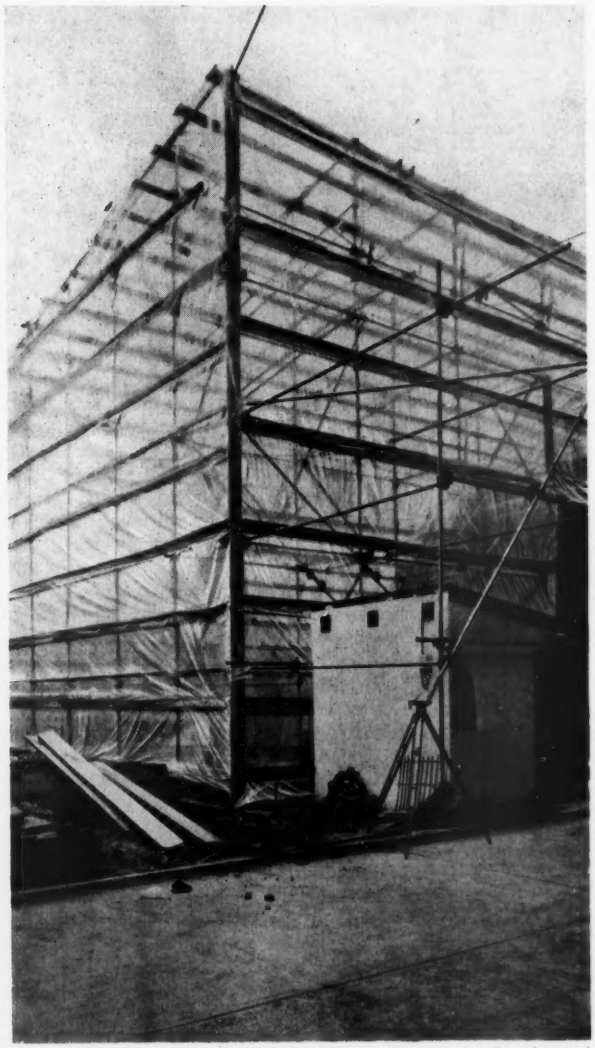

This structure was put up on the British Visqueen site to provide a draught-proof surround for the welding by the "Argonarc" process of aluminium bulk storage silos too big to be fabricated in the factory. The cubic capacity of the structure was 110,000 cu. ft. "Visqueen" 500 (0.005 in.) was used attached to scaffolding boards by light wooden laths and the boards were lashed to tubular steel scaffolding. The cost of the film was about £100. The structure was up for the required time of eight weeks and withstood gale winds and rain during that period.

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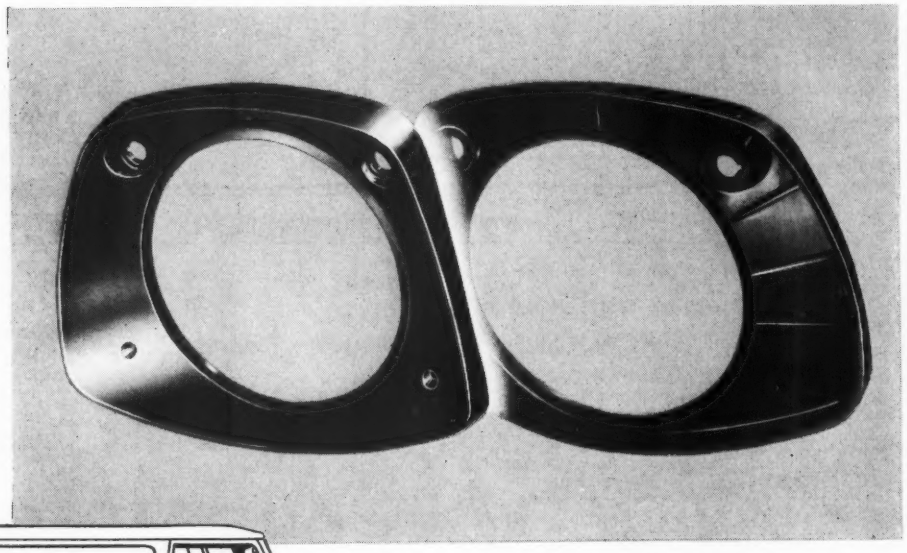

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Plastics

VOL. XXII No. 243 DECEMBER, 1957

EDITORIALS

Amsterdam Exhibition

FROM November 13 to November 20 it was our pleasure and considerably to our benefit to have visited Macro-Plastic (inferring, we presume, " Large Molecule Plastics "), as the Dutch have named their first exhibition of plastics. Since this was, indeed, a truly international show an analysis of it should prove of considerable interest to our readers.

We have already seen the growth of the international exhibition in our own country, which can well stand in stature as a national show but is enhanced by internationality. Holland on the other hand must inevitably, almost unavoidably, stand on international exhibitions. It is a small country that for hundreds of years carved for itself a great tradition in world trade, navigated the seven seas, creating civilization in some of the most primitive corners of the world. It had become rich in its economy as it had become the richest in the arts in the 17th and 18th centuries.

Today Holland is changed, although scarcely to the casual observer. Subjected to the most savage inhumanities of undeclared war, of which no Dutchman willingly speaks, and forced to leave its overseas possessions, it nevertheless retains its original greatness in all eyes because of its people's strength of character and the will to work to repair the ravages of the past. The work began more than 10 years ago and without the great resources of raw material possessed by other nations, it has regained and even strengthened much of its trading relationships, and above all increased and integrated its scientific and technical organizations to a degree not proportionately reached by any other country. We believe that Holland is quite deliberately organizing itself to sell its brains to the world.

To return to Macro-Plastic. Dutch trade in plastics has increased greatly between 1950 and 1956. Thus imports increased in this period from £2,370,000 to £10,000,000 and exports from £1,000,000 to £5,000,000. There are now 40 factories engaged in the manufacture of raw materials (including resins for paints and varnishes) and over 420 factories engaging in moulding and otherwise processing plastics.

At the exhibition there were 172 stands, and while almost half of the products exhibited were of Dutch manufacture, the most significant fact of the exhibition was that about 150 foreign companies (these included Great Britain, Germany, Italy, France, U.S.A., Switzerland, Sweden, Denmark, Canada, Belgium, Austria and Japan) were represented in greater or lesser form. By far the larger number of these were, of course, represented on the stands of Dutch agents: some represented as many as 10 to 14 foreign manufacturers each.

The most significant fact of the exhibition was that it had been organized by the Plastics Institute, a branch of the great T.N.O., the country's research and technological organization. The controlling and advisory committees were composed of representatives of it and interested industries, societies, and federations, including the moulding and fabricating industries, the rubber industry, chemical industry, etc. Through the T.N.O. there is the important link to the Government itself.

Of the exhibits themselves the fairly complete report of 12 pages in this issue tells its own story. The stands were splendidly constructed and were all ready on opening day by a force of labour as eager as the standholders to save time and money on the job.

There was never any cramping of space and many of the designs of the stands showed the value of this attitude and the use of height to get magnificent effects.

It is important to note that we saw almost no shoddy production in any field of work and it was to be noted especially that by far the greater proportion were units and components of " hard " and high technical worth.

There were thus few toys, and even domestic ware formed no large portion of the exhibition: although a great and excellent exhibit of " foamed " mattresses and furniture cushions was to be seen, even more emphasis was made on the value of such materials for packaging of valuable metal components, insulation, etc. By far the greater stress was laid on chemical and engineering structures: piping in the various polythenes and a wide range of fittings, large vessels in polythene and p.v.c. and barrels similarly lined. Glass fibre laminates and other structures seemed to be on almost every other stand, boats and sports cars, components for " mopeds," roof-lighting, an entire lavatory compartment for a railway carriage (this was indeed a *tour de force* by a famous railway engineering company), and long tubes (some 30-ft. high) with changing diameters between top, middle and bottom made by a great armament firm. Nylon, too, was the subject of many stands, and so was high impact styrene sheet—there were some astonishing examples of deep-draws for refrigerator lining in this material of exceptionally low loss in thickness at corners. One of the most intriguing of nylon mouldings we saw was that of a jerry-can for holding petrol—one of the most intelligent of non-mechanical nylon uses we have yet seen.

Excellent, too, were almost all mouldings although in the domestic field the cups and saucers and plates had nothing in them of special design or attraction—with the exception of some examples of Oramin applied design.

Altogether a splendid international exhibition, excellently laid out on one floor, all stands easily " get-at-able," and each very " open," full of colour in spite of over insistence on the severely technical, and a welcome on every stand by a representative as soon as one set foot on it. We found, moreover, no case where English was not spoken. Finally, a large, cheap restaurant where waitresses smiled and laughed and brought excellent food with dispatch.

This exhibition will bring dividends to the Dutch.

Dutch Research

A WORD or two regarding T.N.O., the Dutch organization for research and technology will not be out of place here. In a sense it resembles our own Department of Scientific and Industrial Research in that it is Government sponsored with financial help also provided by various companies in industry. There is, however, a considerable difference for T.N.O. also provides opportunities for students (even foreign students) to study special subjects in the various institutes under the ægis of the T.N.O., namely plastics, rubber, building, metals, agriculture, shipping, etc. There is also a special Institute for testing covering all the activities. Its relations to the Government appear far closer than our D.S.I.R. for the head of the whole T.N.O. is actually a Cabinet Minister, who is continually in close touch with the immediate heads of controlling departments.

In recent years the general interdependent links have been

strengthened and more important, a collating and disseminating of information section, from and to outside industries is in operation. This promises to have world-wide relationships and, indeed, world-wide effects not only in " selling the brains " of the country, but also in pin-pointing who is doing what internationally and thus saving extravagantly wasteful energy and time.

The Plastics Institute of the T.N.O. is like the other section engaged in teaching in research and technology, and during our stay in Holland we were invited to visit the buildings which are being expanded by our good friend Ir. L. C. Stoutjesdijk, one-time head of the Plastics Institute and now deputy chairman of the T.N.O. organization. The Plastics Institute is magnificently organized and we hope at a future date to describe its construction in detail. Here we want to give one or two examples of its technical achievements to date in technical research.

Some few years ago a study was made of potato-starch and the possibility of utilizing the known degradations of it. Today by a brilliant series of technical researches, T.N.O. workers have succeeded in purifying a straight-chain fraction of starch, a sugar-like substance called amylose and producing films from it with considerable technical and commercial value. It is similar in appearance to viscose-type films, is edible and capable of being plasticized and coated. Its use for packaging and sausage casings has already been proved and, indeed, has now appeared on the American market. It is produced in Holland by Avebe of Veendam. We also saw on the laboratory scale production of amylose fibre.

A second research on the conversion of fish-waste has also resulted in potential production of a special type of plastic material. Another valuable piece of work was the construction of a glass fibre/resin police boat in conjunction with the Amsterdamsche Scheepwerf. This was an excellent sturdy vessel on show at the exhibition after 20 months use in the rivers and canals.

Synthetic Rubbers at Last!

IT is a far cry from the 1930's when we bewailed the absence of technical research on synthetic " rubber " in this country and when Germany was steadily marching ahead with her Buna compounds. It is a still farther cry from the 1910's when W. H. Perkin, Jr., and others formed Synthetic Products Ltd. for the purpose near London and failed—it was we suppose too early for this country to succeed economically because of our vast natural rubber resources.

Today, however, we see the fruits of one of the several projects laid down some five years ago between the chemical and petroleum cracking organizations: we refer in this present instance to the Monsanto-Forth Chemicals project. The new factory at the Newport works of Monsanto is now on stream producing some 4,000 tons a year of rubber-like materials, a variety of rubber reinforcing resins designated " Tred " resins, which find their major use in the footwear industry. It is intended to increase capacity in the future to about 6,000 tons a year.

It was our extreme pleasure to visit Newport on November 17 to see the new plant where two types, Tred 50 and Tred 85, are now being produced by the copolymerization of styrene and butadiene. The two forms differ slightly but both are of the high styrene composition. It is significant that these relatively new types containing an increased proportion of styrene in the mix have proved so successful in reinforcing natural rubber and increasing the life of footwear to an astonishing degree.

It is pleasing to note that the whole design of the plant processes were devised by the research department of Monsanto Chemicals Ltd., and the main layout and structure of the plant was designed and built by the company's engineering department from the data obtained from pilot scale plant carried out at the Ruabon factory.

In our January issue we shall describe the processes involved in greater detail and illustrated by photographs of the plant.

Moulding Powder and Shot

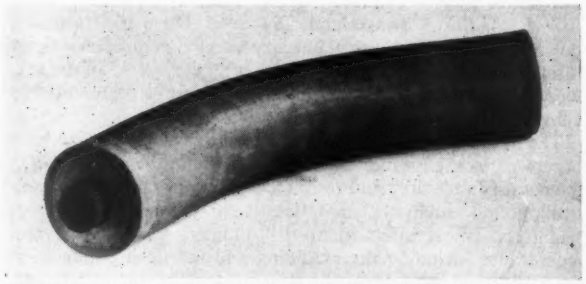
Stalinism in the West

I really don't know what's come over our so called free world. There seems to be a sinister move afoot to strangle democratic trading. Why not admit that it is being ruled by a new form of police state that makes you look over your shoulder every time you try and conduct a bit of honest business? That keen eyed watch-dog of ours *The Daily Telegraph* of November 13 reported that the Californian State Legislature is drafting a Bill designed to curb the activities of more than 50 establishments which issue academic degrees on a pay-as-you go system and quotes the current price of a B.A. degree as £3 7s. 10d., and £10 15s. 0d. for a mail order ordination of ministers of religion. If California is not careful it will drive all such colleges out of business at a time when the said establishments are as efficient as any other factory in the country. I can confirm this from my own experience. Only weeks after I had landed in Mexico on my first job, I received a letter from a mid-western college (who got the names of new-comers from the assistant pursers of all boats calling at the ports) offering me a B.A. for a flat seven dollars (c.o.d. if required) including postage and enclosing facsimiles in black type of B.A., Ph.D. and other degrees. The real degree was to be delivered with my own name hand-painted in gold ink, the degree itself in black ink and signed by both Warden and Registrar of the College in red ink. What with the rising spiral of cost of living and increased printing costs (how well we know it in this office), I should say that today's £3 7s. 10d. compares very favourably with the price of seven dollars of over 30 years ago. In our own modern police state the system has already been killed stone-dead. *Eheu, fugaces* to say nothing of " Où sont les feuilles d'antan? " Fancy a world without M.A.'s, B.A.'s, B.Sc.'s, Ph.D.'s and F.I.S.S.S.M.'s !

The Two did not Mix!

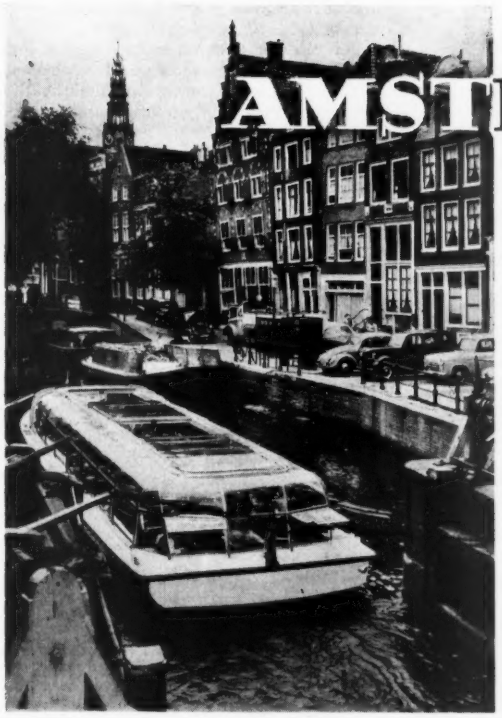
Just in case anybody has not encountered migratory movement of plasticizers or is unaware of the different effects of various plasticizers, here is an example of a composite structure of p.v.c. which resulted in failure. The photograph shows a soft p.v.c. roller made from a plastisol containing di-butyl sebacate as plasticizer. The bearing core ($\frac{3}{8}$ in. o.d.) to maintain stiffness was of rigid p.v.c. After eight weeks the plasticizer from the soft roller had migrated to such an extent that it had softened the hard core. Thus the whole could be twisted and bent in the hands. The core, originally flush at both ends, had increased its length by slightly over $\frac{1}{2}$ in. at one end and by $\frac{1}{16}$ in. at the other.

DOGSBODDY.



Christmas Greetings

to all our readers from the staff of ***Plastics*** *and best wishes for a happy and prosperous New Year.*



AMSTERDAM 1957

A report on the International Plastics Exhibition held in Holland in November last. Amsterdam made overseas visitors more than welcome and to indicate our appreciation we have included on this page the city's arms.

(Left) A typical Amsterdam scene. In the foreground is one of many sight-seeing boats, completely glazed in Perspex.

A NEWCOMER to the field of international plastics exhibitions, Holland scored an outstanding success by obtaining the support of over 170 stand-holders for the show in November.

Held at the R.A.I. building in Amsterdam, the exhibition was organized by the T.N.O. organization in conjunction with Dutch plastics companies. Forty-two per cent. of the companies exhibiting were Dutch, the remainder being overseas organizations. The full details are as follows:

	Holland %	Germany %	Britain %	U.S.A. %	Others %
Raw material manufacturers	33	29	14	8	16
Semi-finished goods manufacturers	40	36	7	4	13
Consumer goods manufacturers	83	5	5·3	0·2	6·5
Machinery manufacturers...	12	45	29	—	14
Total	42	29	14	3	12

From the above it is clear that the plastics industry of Europe generally regarded this exhibition as important, reflecting perhaps Holland's traditional role as the clearing house for Europe's merchandise. It also indicates that Holland constitutes a fruitful territory for the sale of plastics materials, machines, and consumer goods. Dutch imports of raw materials and semi-finished products in 1950 were valued at F1.23 m.; in 1956 this had risen to F1.100 m. Exports also showed a similar proportional increase, from Fl.11 m. in 1950 to Fl.51 m. in 1956.

In fact, Holland has fully shared the overall increase in plastics production and consumption, indicated by the fact that world production of plastics, estimated in 1950 as 1½ million tons, had increased by 1956 to 3½ million tons. Sales of plastics in Western Europe were roughly 350,000 tons in 1950, increasing almost four times by 1956 to 1,200,000 tons."

Britain's plastics industry was well represented at Amsterdam, not only by individual companies who exhibited through their Dutch agents, but also by the joint stand of the British Plastics Federation. One of the biggest at the exhibition, the stand was staffed by B.P.F. personnel and by officers of individual companies. Many members of the Federation contributed items of manufacture for display on the stand.

At a preview to the exhibition, on November 12, Mr. David Radford, chairman of the B.P.F. Publicity Committee, spoke of the phenomenal growth of Britain's plastics industry. " In ten years," he said, " output has increased ten times, to a new record level this year of 400,000 tons.

In the report which follows, we highlight some of the most interesting features seen at the exhibition. The exhibits are segregated under the headings plastics applications, materials, and plant and equipment. At the end is a list of exhibitors' names and addresses mentioned in the following pages. Our gratitude is recorded here of the never-failing help we received from the organizers and exhibitors in compiling this on-the-spot account of the Amsterdam Exhibition of 1957.

(Right) A general view of Holland's first Plastics Exhibition. The general level of stand design was very good and the lay-out of the exhibition was excellent.

Plastics Applications at Amsterdam

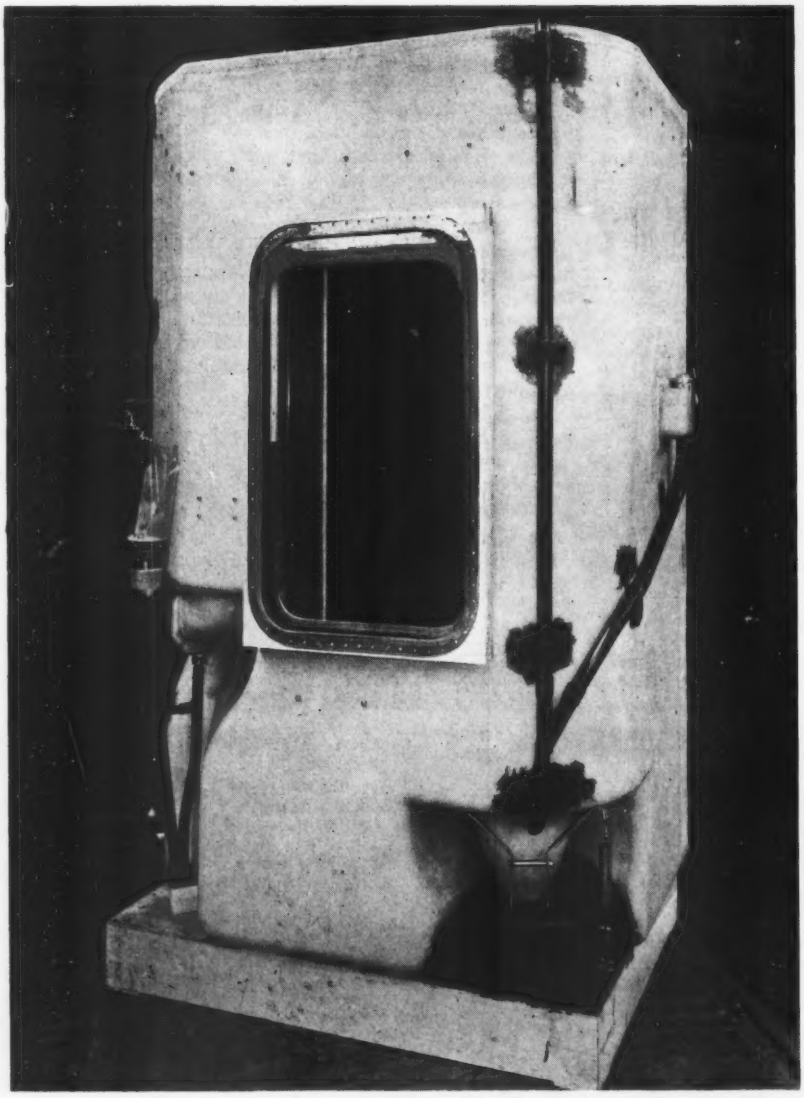
Boats

A new dinghy for yachtsmen, shown at the exhibition, was moulded in reinforced polyester-glass materials, and called "The Flying Junior." The length overall is 4.03 metres and the breadth 1.5 metres. The boat is constructed by **van Boven Kunststoffen Industrie,** of Gorinchem. Apart from the attractive lines of this craft, the manufacturers also claim great durability and a much lower price than would be obtainable with traditional materials.

Railway Applications

A major display at the exhibition was that of the **Werkspoor N.V.,** the Netherlands railway manufacturing company, with works at Amsterdam and Utrecht.

For many years this company has maintained an experimental plastics department, to keep a watching brief on new developments in plastics materials and technology. As a result of this, a number of important developments have been achieved, not the least of which is a complete toilet installation for international trains, moulded in one piece from polyester/glass material. A fuller description of this process will be published later in *Plastics*, but meanwhile readers will be interested to see the photograph which is shown below of the exterior of the unit. Werkspoor have gone to considerable lengths to ensure that each product is very carefully controlled. By careful experimentation they have found that it is possible to fabricate structures a square yard at a time. The worker is supplied with enough material for each square yard and does not proceed further until the first unit has been satisfactorily completed. In this way complete control is maintained at all times on the quality of products manufactured.



Exterior view of semi-finished railway toilet installation in polyester-glass byWerkspoor N.V.

Polyester—Glass Lampshades

Matched metal dies were used by a Copenhagen company for the moulding of decorative lampshades in the contemporary style. Using various pigments and by incorporating threads of woven roving, attractive patterns were obtained one of which is shown in the photograph below. The Dutch agents for these shades and other fabrications in polyester glass materials are **Beumer Plastics.**

Polyester-glass lampshade in the contemporary style.

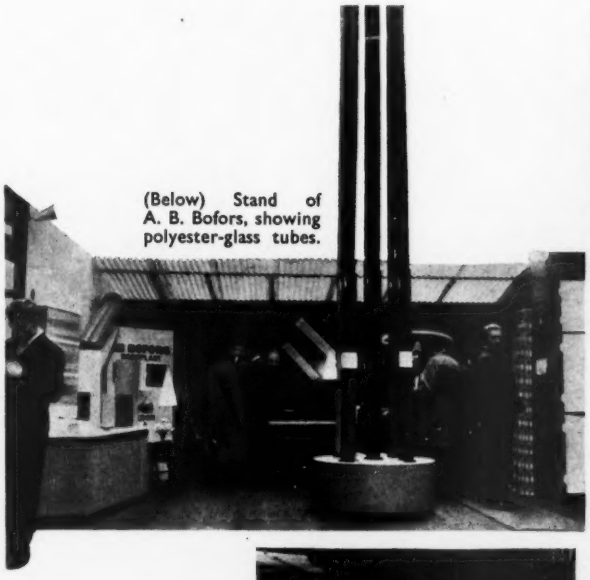
Building

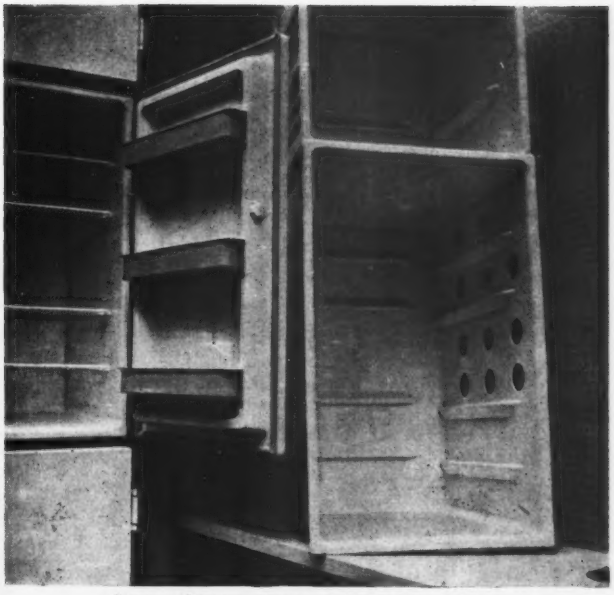
Extruded Mipolam, p.v.c. manufactured by **Dynamit A.G.,** Troisdorf, was shown in many building applications. One of the most interesting was the use of rectangular and other sections to form a weather-proof seal for double windows. It was clear from the many sections on display that a considerable volume of p.v.c. extrusion is finding use in this type of application alone. It is also possible that particularly in West Germany where building standards are extremely high, the successful use of p.v.c. in this application will help to convince municipal and other undertakings of the suitability of extruded plastics in other spheres, such as cold water services, guttering, etc.

Flooring

Shown for the first time by **Synprodo N.V.,** was an expanded polystyrene-concrete laminate, the polystyrene being reinforced with metal herringbone sections. Marketed under the trade name Tempex, the laminate is in the form of square slabs, the concrete being uppermost. Designed for flooring in houses, terraces, factories, etc., the advantages include heat insulation, damp-proofing, elimination of dry rot, and sound insulation. If the development proceeds according to plan, a large outlet will exist here for expandable polystyrene granules.

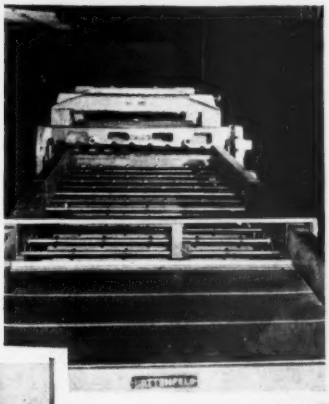
(Below) Stand of A. B. Bofors, showing polyester-glass tubes.





(Above) Vacuum formed refrigerator liners, exceptionally deep drawn, shown by Bofors.

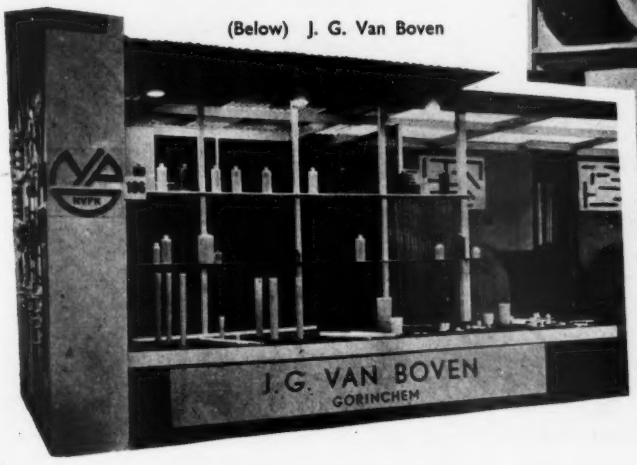
(Right) Cutting and palletting section of the Battenfeld automatic sheet extrusion plant.



(Below) Badische Anilin and Soda-Fabrik

(Above) Motor scooter body in polyester-glass shown by Beumer Plastics.

(Below) J. G. Van Boven



AMSTERDAM 1957

Synprodo were also showing expanded polystyrene in sheet form for insulation against cold, damp and noise, in general building applications and also for special purposes.

P.v.c. loaded with asbestos in the form of floor tiles was shown by **Fabrikaat Linoleum, Krommenie.** An eye-catching display had been arranged by the creation of a mural, shown in a photograph elsewhere in this report. Stark and dramatic, the mural forcibly demonstrated that on the grand scale, as well as in the kitchen, p.v.c. flooring tiles could be used to great effect. Krommenie also showed extruded sections to give a radiused contour to the floor edges, in colours to match the tiles. The company's products are marketed under the trade name Colovinyl.

Packaging

Four-foot drums, 2 ft. in diameter, made in polythene by the sintering process, were shown by **Van Leer's Vatenfabrieken N.V.,** using the U.S. Delaware process under the trade name of Valathene. Drums of this kind can be used as interliners with metal, plywood or fibre structures, or by themselves, and are ideally suited for the transport of foodstuffs, such as butter, syrups, sugars, etc., and for chemicals, corrosive or otherwise, where complete freedom from contamination must be maintained. A complete range of accessories was shown by van Leer, including taps and hose fittings in polythene.

Roofing

Edilon N.V. showed a range of plain and pigmented polyester-glass roofing materials. In a country where agriculture and market gardening form such an important part of the national economy, a robust but translucent roofing medium is of obvious interest, and the Edilon display was but one of the many of this type.

Polyester Glass Tubes

A. B. Bofors, the well-known Swedish company, have for many years operated an experimental plastics department. The fruits of some of this department's work were shown at Amsterdam, in particular five polyester/glass pipes and a number of deep drawn vacuum formed styrene sheet articles. The pipes are made by a process specially devised by Bofors and can be constructed with minimal tooling costs. They can be manufactured in any length, limited in most cases by the practicability of transport when leaving the factory. At the moment, pipes of 30 ft. lengths are standard production although 60 ft. pipes have been made. They are custom made to different cylindrically tapered or double tapered profiles and at the moment are used as boat masts, ventilation pipes and flag poles. They are characterized by high strength with a low weight ratio and require no maintenance. It will be interesting to see whether the availability of a simple process with low tooling costs for the production of these pipes will enable reinforced plastics pipes to make a wider impact on industry than has been the case so far.

One of the largest stands at the exhibition, the British Plastics Federation display undoubtedly created considerable interest. A large number of mouldings had been brought in from Britain to demonstrate the versatility of the British plastics industry in all its activities. The stand was staffed by Mr. B. Aldis and colleagues from the Federation in London, together with additional representatives from various British companies who had made available their services free. The centre piece of the stand was the Ferguson tractor supported entirely by 12 strips of Melinex, giving adequate demonstration of the strength of this film. Seen in the photograph is Sir Paul Mason, British Ambassador to Holland, inspecting the Federation stand.

Chemical Plant in Polyester Glass

Hulskamp N.V., of Alkmaar, showed a number of large constructions in polyester-glass designed for the chemical industry. A particularly interesting unit was a large tank, the outside of which was relatively rough in appearance but the inside of which was completely smooth. No attempt had been made therefore to achieve an attractive finish from the exterior point of view. The tank is strictly functional in the sense that any material contained within it can easily be cleaned after use from the smooth surface.

Deep Drawn Vacuum Formed Articles

The **Bofor's Company** have also developed a process for vacuum forming articles, such as refrigerator liners with a degree of depth of draw hitherto unobtainable. Several examples of these were shown by the company at the exhibition. A particularly important one was a refrigerator interior which measured 4 ft. by 2 ft. with a depth of draw of 3 ft. No excessive thinning was noticeable over the whole surface and the process is claimed to be an original Bofors development.

Polyurethane Foams

One of the most comprehensive displays of polyurethane foams yet organized was shown by the **Internationale Kunststoffen Industrie N.V.** A photograph of this stand is shown elsewhere, and indicates the tremendous use of polyurethane foam material that had been used to decorate the stand. The raw material which is imported into Holland, is converted at a special factory into sheets and slabs, for subsequent fabrication into a number of forms. For example, the Slumberland Mattress Co., of Great Britain, has a trading agreement with I.K.I. under which I.K.I. are the exclusive suppliers of polyurethane mattresses to the English organization. The very low specific gravity of these foam materials, 0·04, plus their resistance to oxidation, sunlight and chemical attack, provide them with many advantages in the field of upholstery, particularly in motor cars and domestic furniture.

Pipe Fittings

A very interesting display was organized by **W. J. Stokvis N.V.,** of nylon pipe fittings for building and chemical and other purposes, according to ISO specifications.

Gas Welding Equipment for Polythene

The welding equipment for the fabrication of polythene, manufactured by **Rediweld Ltd.,** was displayed by **Dikkers and Co. N.V.,** of Hengelo, Holland.

Tubing

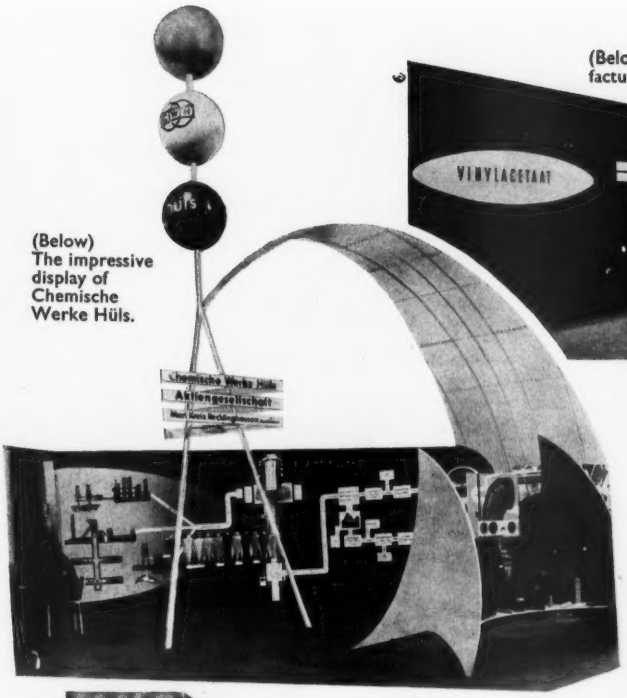
Apart from Dutch extruders who showed their products, a number of other extruder companies were represented. One, **Société Pours les Métaux Ouvrés,** of Geneva, exhibited through their agents in Holland, **J. D. Banting N.V.** Polythene tube and piping, under the trade name Somoflex, was shown for a wide range of applications, including cold water services, agricultural conduit, piping milk, and for chemical plant. Somoflex is made in several grades, as is Somoplas tubing, p.v.c. in flexible and semi-rigid lengths.

P.V.C. Fittings

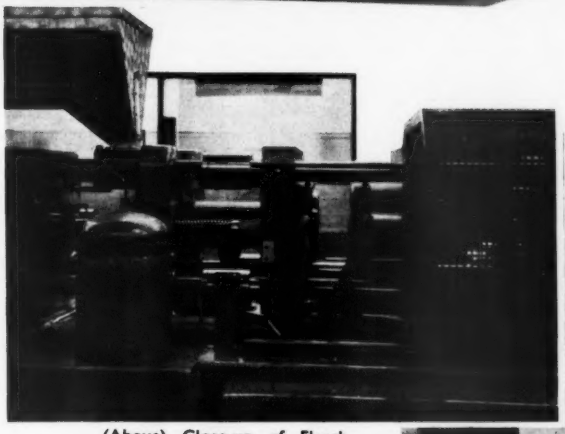
One of the most complete selections of p.v.c., polythene and polyamide pipe fittings in almost every available shape, complexity and size was to be seen on the stand of **Peck & Co. N.V.** This company represents **Georg Fischer A.G.,** of Schaffhauser, Switzerland, and also **Polypenco,** of Reading (Penn.), U.S.A., for nylon flexible pressure piping.

(Below) Electro Zuur- En Waterstoffabriek N.V., manufacturers of vinyl acetate monomer.

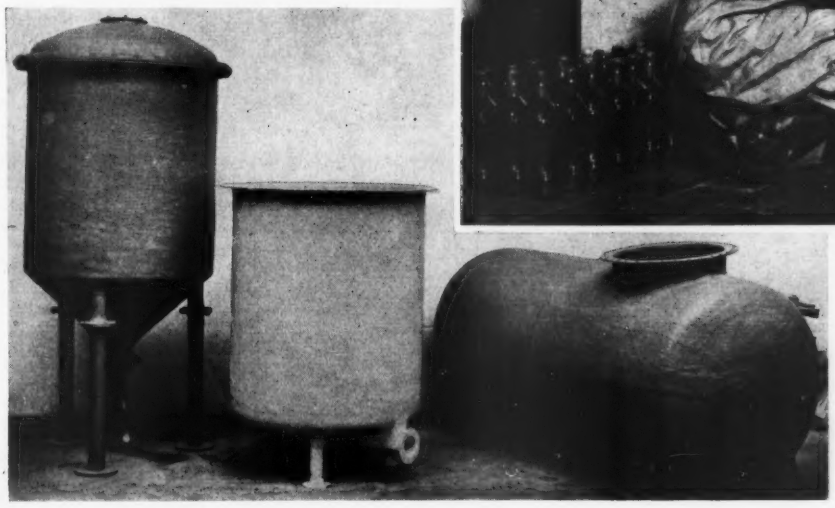
(Below) The impressive display of Chemische Werke Hüls.



(Above) Perspex bath made by Thermo-Plastics Ltd., Dunstable, shown by Geveke and Co. N.V.



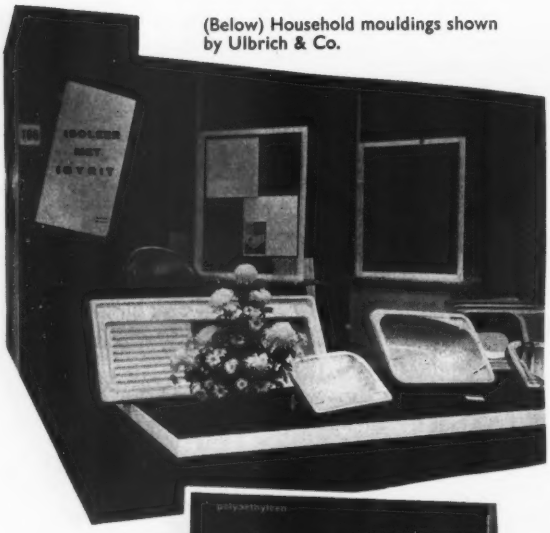
(Above) Close-up of Flesch injection moulding machine.



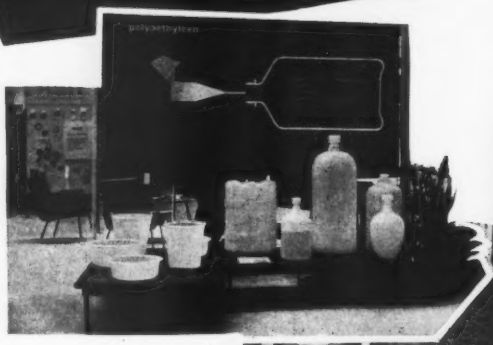
(Above) Fischer bottle blowing machine seen here in Shell laboratories, Holland, moulding transparent p.v.c.

(Left) Chemical plant in polyester-glass shown by Hulskamp N.V.

(Below) Household mouldings shown by Ulbrich & Co.



(Above) General view. (Below) Polyester-glass boat.



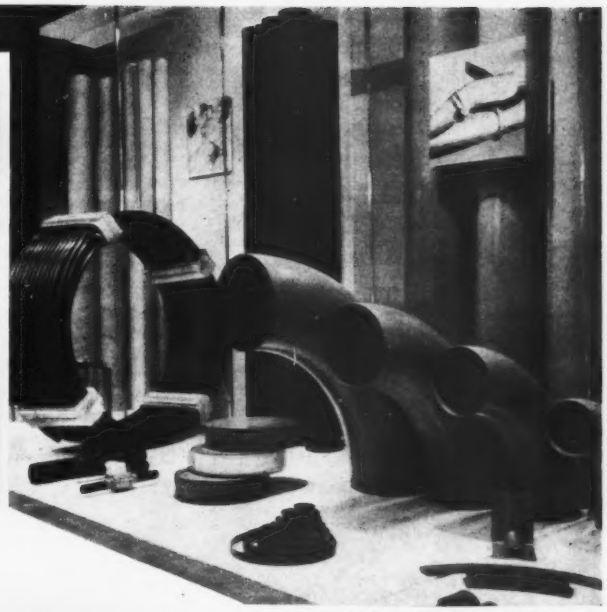
(Above) Polythene mouldings.

(Right) Shell display.

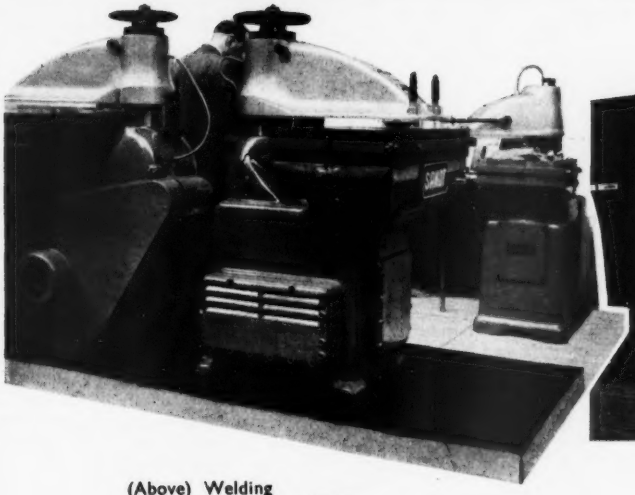
(Below) Glass and glass products shown by Weber.

(Below) Bus moulding in polyester-glass by Werkspoor N.V.

(Below) Bus cab moulded with Solvay polyester resin.

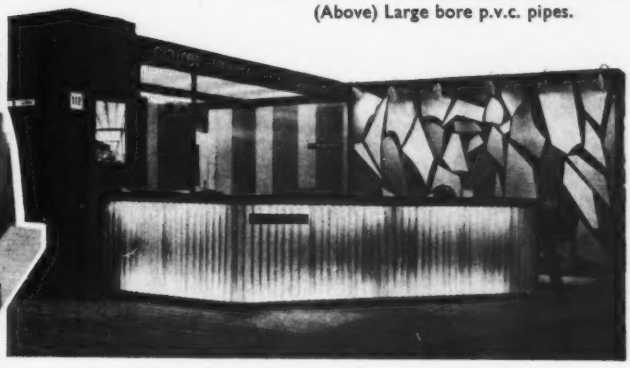


(Above) Large bore p.v.c. pipes.



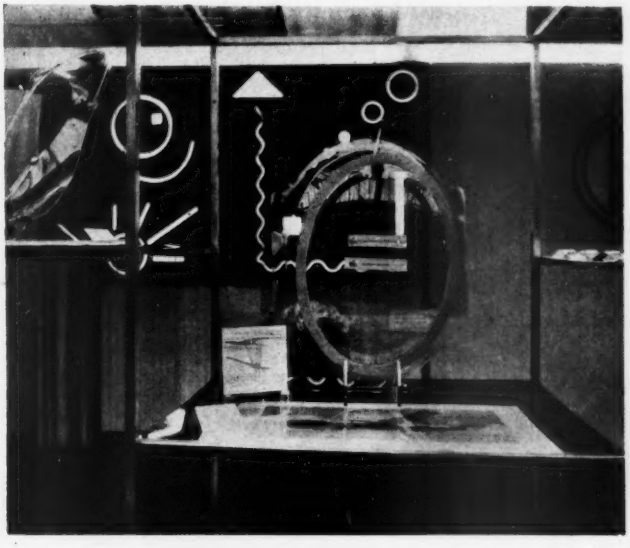
(Above) Welding machines shown by J. Sandt.

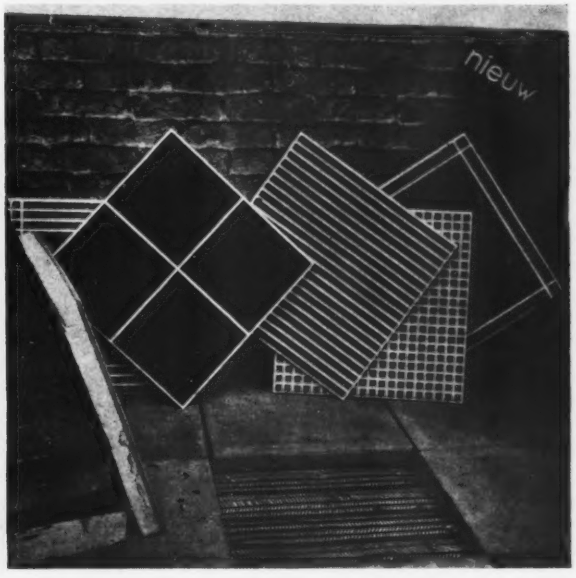
(Below) Aircraft windows.



(Above) Display by Triplexhandel.

(Below) Expanded polystyrene flooring material shown by Synprodo N.V.





Plastics Materials

Expanded Polystyrene

Styrene Products Ltd. were represented on the Shell stand and one of their displays comprised the Styrocell expandable polystyrene granules. In the expanded form, this type of polystyrene has a density of 1 lb. per cu. ft., and impact strength of 0·54 in./lb. per inch unnotched and a tensile strength of 22·3 lb. per sq. in. Expansion of the granules can be carried out simply by submerging the polymer in a bath of hot water at a given temperature, usually in the order of 80° C. to 95° C. Period of time of immersion will also determine the degree of expansion of the mass. Blocks made in this manner are allowed to cool to room temperature when they can be cut up into boards or planks of whatever thickness is required. Major outlets for this material include insulation in cold-storage rooms, refrigerated vans and lorries, ice-cream cabinets, cars and caravans, houses, factories and offices and in ships and aeroplanes. The material is also now finding wide application for buoyancy, packaging, for display and for novelty toys.

Vinyl Acetate

A well-known Dutch company, **N.V. Electro Zuur-en Waterstoffabriek,** organized an extensive display of products derived from calcium carbide, in particular vinyl acetate monomer. Although the company does not polymerize the monomer, nevertheless it supplies a wide range of companies who convert the material into paints, surface coatings, paper and textile treatments.

Glass for Reinforced Plastics

Firma Weber, Dutch agents for the **Owens Corning Fiberglas Co.,** showed a range of cloths available from the American company and also several moulded articles, including a boat.

Sales of Chemical Products

The Netherlands Sales Office for Chemical Products Ltd., of Amsterdam, was formed in 1947 and sells the products of the **States Mines** in Limburg, the **Koninklijke Zwavelzuurfabrieken v/h Ketjen N.V.,** the **N.V. Koninklijke Nederlandsche Zoutindustrie,** and the **N.V. Maatschappij tot Exploitatie van Kooksovengassen.** Through the company are obtainable such basic commodities as liquid chlorine, hydrochloric acid, caustic soda, sulphuric acid, nitric acid, liquid ammonia, oxygen and nitrogen, cyclohexanol, and caprolactam. One of the purposes of the company is to organize the sales of Holland's basic chemicals abroad.

In addition to the sale of home manufactured products, the Netherlands Sales Office for Chemical Products also handles the sales in Holland of a number of important overseas companies, including the **American Cyanamid Co., The Dow Corning Corporation, The Norsk Hydro-Elecktrisk, Midlands Silicones Ltd., Chimiques du Silicium,** of France, and a number of other companies. A display of products manufactured from Midland Silicone materials were shown by the company on its stand.

Synthetic Rubber

Samples were shown on the **Shell** stand of the company's synthetic rubber of the styrene-butadiene type. Over twenty different types of rubber and latex are produced at the Torrance, California, plant of Shell. Denoted hot rubbers, they are prepared at moderately warm temperatures around 120° F. Butadiene and styrene being brought together in an aqueous emulsion using fatty acid or rosin soap as an emulsifier. The catalyst is added and the charge is allowed to react to the desired extent of conversion. An example of a non-pigmented hot rubber, is S1000, a general purpose synthetic rubber containing a staining stabilizer and prepared with a fatty acid emulsifier. It is adaptable to most products where staining is not critical.

Akulon nylon was featured by Algemene Kunstzijde Unie, N.V.

Urea and Melamine Materials

Products of **B.I.P. Chemicals Ltd.** were exhibited by the Dutch agents, **Merrem & La Porte N.V.** A particularly attractive display was arranged of the melamine and urea moulding materials, together with the Beetle alkyd dough moulding compounds. These latter materials were seen publicly for the first time at the British Plastics Exhibition in London in July.

Glass Fibre and Resins

Representing some 14 American and German raw material companies manufacturing phenolic, urea, polyesters, p.v.c., etc., glass fibre in a variety of forms and wood-laminates, some impressive glass fibre/glass structures made by Dutch fabricators were on view on the stand of **Kamphuys & Oosterbaan N.V.** Among the rarer polyester laminates were some made with jute as the reinforcing material.

Epoxy Resins

Shell Chemicals, not unnaturally, had a very large display at the exhibition. One of the chief features was the display of epoxy resins marketed under the Shell trade-name of Epikote. These resins are sold in a number of grades, with melting points ranging from 64° C. to 155° C. The molecular weight distribution is equally over a wide range, from 900 in the case of Epikote 1001 to 3,750 in the case of Epikote 1009. The viscosity also rises with molecular weight.

Capable of being cured at room temperatures by the addition of an amine catalyst, these materials are now finding application in specialized fields such as aircraft structures. **Fokker,** the Dutch aircraft company, make use of considerable quantities of epoxy resins in the construction of the Friendship airliner. The advantages include considerable saving in weight and considerable saving in terms of fabricating time. In addition to being used as bonding agents, in conjunction with glass fabric and chopped strand mat, the Epikote resins are used in surface coating form for chemical plant protection, for drum coatings, wood finishes, paper coatings and for special purpose synthetic lubricants and hydraulic fluids. Comprehensive technical information is available on these resins in booklet form from Shell Chemicals.

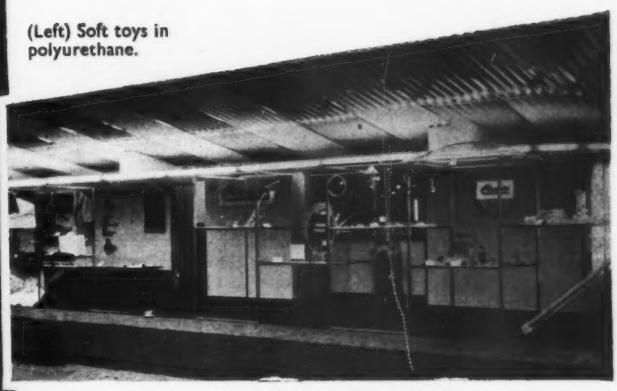
Injection Moulding Machines

The Dutch company **Was de Wit N.V.,** agents for Dowding & Doll Ltd., exhibited the fully-automatic injection moulding machine. The Westminster injection machine was also shown.

Polymethyl Methacrylate

Shown by **Frese and Van Beusekom,** were the **Rohm and Haas** materials Plexiglas, polymethyl methacrylate, and Plexidur T, polymethyl methacrylate copolymer. The latter material is used for the inner and outer windows of the new Fokker aircraft the Friendship. On the stand were many other examples of fabrications from these acrylic materials manufactured by Rohm and Haas.

(Left) Soft toys in polyurethane.



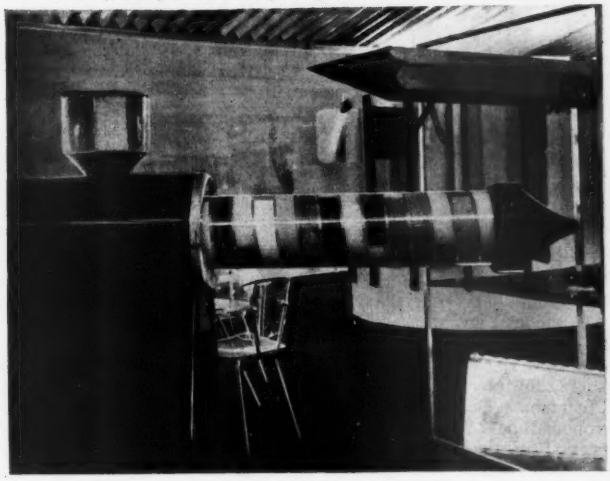
(Above) Rohm and Haas display.

(Left) Sintered polythene drums.

(Above) P.v.c. tiling display.

(Below) The Nautamix mixer.

(Below) A colour display by Rohm and Haas.



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Nylon

Akulon nylon, manufactured by **Algemene Kunstzijde Unie N.V.** of Arnhem, Holland, was displayed on the AKU stand. Very full technical literature about the Akulon range of nylons is available from the company in the form of two booklets, one dealing with mechanical properties and one with physical properties. These booklets have been extensively revised and brought up to date and in addition to general information, contain specific testing information relating to ASTM methods of test. The stand itself, as seen in the photograph on page 478 was decorated with many examples of mouldings made of Akulon nylon. Of special interest were the items fabricated by the injection moulding process for the textile industry.

Polyvinyl Chloride

Shell p.v.c. is manufactured under the trade name Carina. Carina 16 is a general purpose grade high molecular weight p.v.c. suitable for the manufacture of a complete range of plasticized products. The polymer has a fine particle size enabling it to absorb plasticizers readily and homogeneously, giving the product easy selling characteristics which allow for short milling cycles. Typical physical properties of Carina 16 include a specific gravity of 1·4, a bulk density of 0·36 grams/c.c., a moisture content of 0·05% and a K value, in cyclohexanone of 70. A detailed booklet on Carina 16 has been prepared by Shell and was distributed at the exhibition.

Plant and Equipment

Injection Moulding Machines

Injection moulding machines manufactured by **Dr. Ir. Fritz Sommer** were displayed. These machines are designed to work automatically and were in operation during the exhibition, working on many different types of materials. Amongst the materials tested for the benefit of the onlooker were Tenite polythene from Eastman Kodak, polystyrene manufactured by Kleestron Ltd., and many others.

Injection and Extrusion Machines

Wilmod Compagnie N.V., the Dutch agents for **R. H. Windsor Ltd.**, organized a very large display of Windsor equipment. This included the SH3 and SH4 injection moulding machines, the Autoplas 1044 preplasticizing injection moulding machine, the 3½ inch single-screw extruder having a through-put capacity of 250 lb. per hour, and other equipment.

Instruments

Reliability, robustness, control within fine tolerances are vital for temperature controllers governing moulding machines, extruders, etc. A wide range of the well-known West Instruments were on view on the **G. L. Loos & Co. Fabrieken N.V.** stand. This is the Dutch agency for the Chicago company, the stand being shared with the German agency run by **Werne Kühne.** Also on view were pressure measuring instruments.

Machinery

A big display of B.I.P. Engineering's Bipel automatic compression, transfer and pelleting machines, all working hard throughout the show were exhibited on the stand of **Werkmetaal N.V.**, where there was also found **Ankerwerk's** injection machines, **Buss** mixers and kneading machines and **Englehardt** weighing and "dosing" machines, one of which was feeding a Bipel press.

Resin Spraying Equipment

Shown at the British Plastics Exhibition in July, the M.A.S. spray machine was exhibited in Amsterdam by **Aust und Schuttler.** Employed for spraying polyester resin, catalyst, and glass, in simultaneous jets on to the mould surface, the machine has also been under test in the United Kingdom by Coronet Cars Ltd., who are the British agents.

High-Frequency Welding Machine

Maxinec, of Schiedam, showed a Dutch-built high frequency welding machine suitable for handling p.v.c. in sheet form. Operating on the pneumatic principle, the machine is attractively designed and robust in appearance. The machine has a built-in unit to guard against overloading; in the event of a discharge of the material to be welded, the high frequency current is cut out and the press lifts automatically.

Vacuum Forming Machine

The single mould unit, constructed in the conventional manner with the heater unit moving on rails above, was shown by **Maxinec.** This vacuum forming machine has been specially designed to deal with thermoplastic sheet such as p.v.c., cellulose acetate, methyl methacrylate and high impact polystyrene. At the moment, the machine has been purchased particularly by people interested in the packaging industry, especially foodstuffs packaging. The heater panel is of the infra-red type, heating by 12 elements of 500 w. each. The machine will handle about 100 sheets of material an hour.

Brushback Sanding Heads

Shown by **J. C. H. van Duyl jnr.**, of Rotterdam, were the Engis-Vonnegut brushback sanding heads. By the use of these heads, costly finishing can be very largely reduced. They are also eminently suitable for the finishing of irregular shapes and operate at very high speeds.

Grinding Equipment

J. C. H. van Duyl jnr., of Rotterdam, also showed the Abradisc universal grinding equipment, comprising abrasive adhesive discs and flexible rubber holders. These items are used in the manufacture of plastics moulds and dies.

Diamond Polishing Compounds

The Hyprez diamond compound, an abrasive compound consisting of pure accurately graded diamond powder permanently suspended in a stable chemical base were shown by **J. C. H. van Duyl jnr.**, of Rotterdam. The Hyprez diamond polishing compounds have been used for a considerable period of time in the finishing of plastics moulds and dies.

H.F. Heating and Welding Apparatus

A completely automatic H.F. heating and welding apparatus was on show at the stand of **Maxinec N.V.** and, specifically for the packaging industry, a vacuum forming, filling, and sealing machine, the whole working automatically and continuously.

Automatic Dosing Machine

A fully-automatic electric dose-weighing machine for synthetic materials was shown by **Engelhardt G.m.b.H.**, of Fuerth, Bavaria. The machine is made in two types, the first having a weighing pan which is emptied by depressing a hand lever. Provision can also be made for this type of machine for the emptying to be performed automatically with an injection piston. Type two is equipped with an electronically controlled emptying device working fully in unison with the machine.

Extruders

Johann Fischer, of Lohmar, near Cologne, showed two machines. The first was one of their general range of extruders, ranging in throughput from 10 to 100 Kg. per hour. These machines are of very robust appearance and follow the now accepted practice of having their controls mounted on separate panels. A major feature of the range is the spread of die heads and ancillary gear made to be used with them. Eight types of head are standard production features, including angled take-offs, wire-covering heads, sheeting heads, and twin heads. The company also markets sheet haul-off plant, compounding plant, and film plant. The last mentioned is arranged so that the tube is extruded downwards into the reeling and slitting machinery.

Fischer also showed a new bottle blowing plant. One of these machines is already installed at the Shell Laboratories in Holland. A photograph, on page 475, shows the machine in operation. Very high output rates are obtainable.

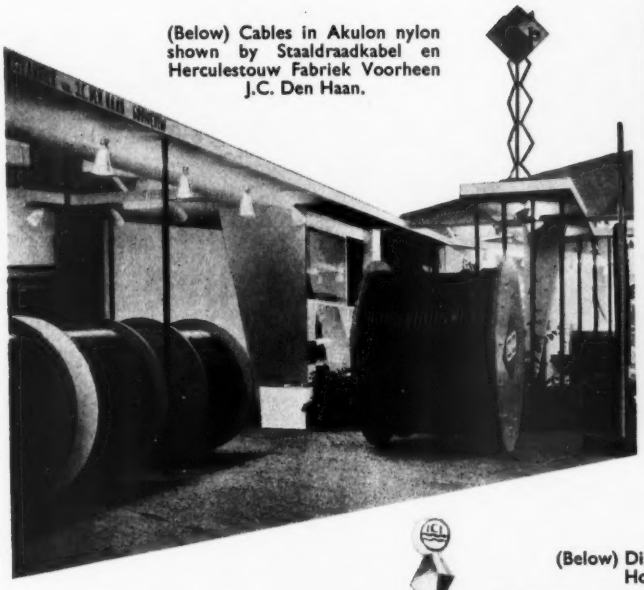
Extruders

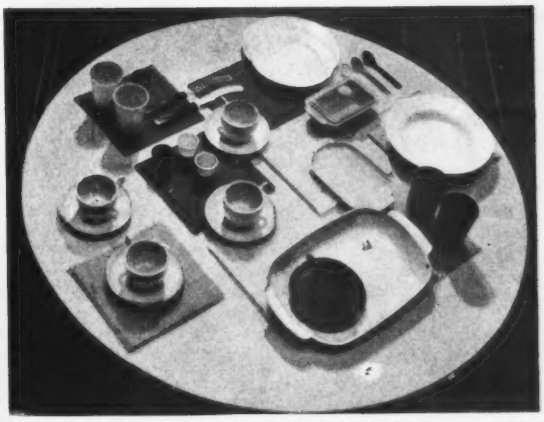
One of the largest machinery stands at the exhibition was that of **A. Reifenhauser,** of Troisdorf, West Germany. Amongst the machinery on display was the S45 RGV extruder, details of which have been published on previous occasions in *Plastics*. Shown with this machine was the complete take-off plant for tube manufacture. The S45 machine has a screw length/diameter ratio of 15:1, with a screw speed, infinitely variable, of 18 to 91 r.p.m. The output of the extruder according to material and cross-section lies between 22 and 44 lb. per hour.

Sheet Extrusion

Battenfeld, the well-known German company, had a large display of injection moulding and extrusion equipment. Attracting considerable attention, especially when it was operating, was the complete sheet extrusion installation which embodies a number of novel ideas. The diehead from which the sheet material is taken can be opened and closed by means of twin hydraulic rams positioned beneath the diehead itself. Another important feature is that at the haul-off end of the equipment a new slicing device has been incorporated. By means of this equipment, sheet having passed through the final set of

(Below) Cables in Akulon nylon shown by Staaldraadkabel en Herculestouw Fabriek Voorheen J.C. Den Haan.

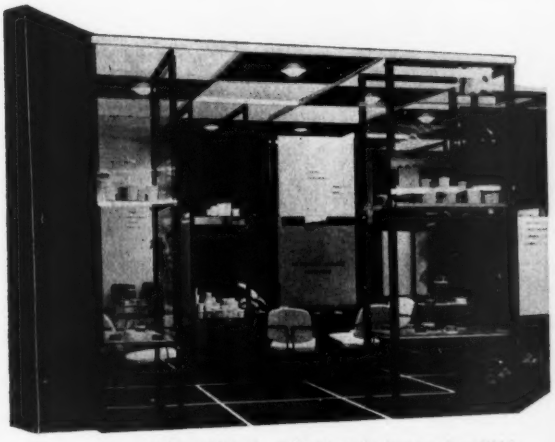


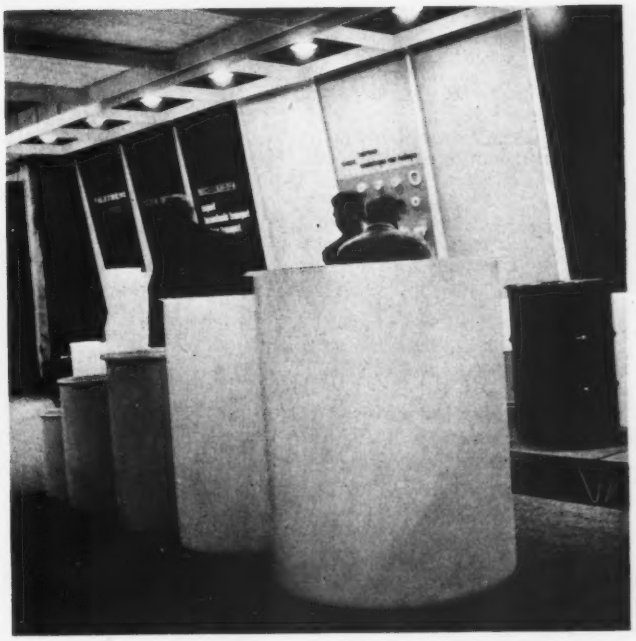


(Above) Tableware moulded by Internationale Kunststoffen Industrie N.V.

(Below) Display by Farbwerke Hoechst A.G.

(Above) Perspex featured on the stand of Imperial Chemical Industries (Holland) N.V.





(Above) Kunststof Industrie Amsterdam N.V.
(Right) Sintered polythene drums shown by van Leer's Vatenfabrieken N.V.

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haul-off rolls is carried to the end of a table where it trips a switch. The guillotine then comes down on to the sheet; the table, of special construction, contracts from each end, and allows the sheet to drop on to a pallet below. The pallet moves down one thickness of sheet as each sheet is loaded until when full it is resting on wheels and can be withdrawn from the machine and a new pallet inserted. The complete equipment which is being sold in Germany for between £12,000 and £14,000 is probably the closest approach to complete automation for sheet fabrication that is available at the moment.

In the injection moulding field, the range of B.S.M. machines were shown. The Dutch agents are **Battenfeld Nederland N.V.**

Automatic Screen Printing Machines

Demonstrated by the Dutch agents, **Export Service,** of the Hague, a range of automatic screen printing machines, manufactured by **E. Mertes & Co.,** of Bad Kreuznach, Germany, were shown. Electronically controlled, with automatic register for speedy and direct screen printing on any surface, round, cylindrical, conical or flat, the machines have been designed to print a permanent label in one or more colours. The machines are capable of handling glass, chinaware, ceramics and plastic materials such as p.v.c., polystyrene and polythene. The machines are simply controlled and are operated by one person. The machines can also be made available with a heating system for the use of thermoplastic inks and can also be fitted with a pressure device for dealing with very thin articles.

Bottle Blowing Equipment

P. Flesch, the German company, showed a range of plastics fabricating machinery, one of the most interesting of which was a bottle blowing unit which can be attached to a typical Flesch extruder. Apart from the main extrusion control panel, a separate panel is also arranged to control the bottle blowing part of the apparatus.

Flesch also manufacture injection moulding machines with shot capacity from 2 oz. up to 8¾ oz., using polystyrene as the standard medium. An interesting unit is the fully hydraulic vertical injection moulding machine, type VEVHSI, designed in accordance with the latest moulding techniques. These machines have been constructed as a means of saving space, and to facilitate the use of inserts in complex mouldings.

Directory to Companies

A number of reports and photos have had to be held over to next month. The list of names and addresses below includes companies whose exhibits will be reported in January.

Algemene Kunstzijde Unie N.V.,
Arnhem, Holland.

Allard Kunststoffen en Technica N.V.,
Herengracht 528, Amsterdam, Holland.

American Cyanamid Company,
New York, U.S.A.

Ankerwerk Gebr. Goller,
Rennweg 37, Neurenberg, Germany.

Aust & Schuttler u. Co.,
Graf Adolfstrasse 81, Dusseldorf, Germany.

Badische Anilin- & Sodafabrik A.G.,
Ludwigshafen a. Rh., Germany.

J. D. Banting N.V.,
Kloveniersburgwal 45, Amsterdam, Holland.

Battenfeld Extruderwerk Siegburg,
Sieburg, Germany.

Battenfeld-Nederland N.V. i.o.,
Rokin 30, Amsterdam, Holland.

Farbenfabriken Bayer A.G.,
Leverkusen, Germany.

B.B. Chemical Co. Ltd.,
Leicester.

Beumer-Plastics,
Prinsestraat 38 B, Den Haag, Holland.

B.I.P. Chemicals Ltd.,
1 Argyll Street, London, W.1.

B.I.P. Engineering Ltd.,
Streetly Works, Sutton Coldfield.

A. Boake, Roberts & Co. Ltd.,
Carpenters Road, Stratford, London, E.15.

Board of Trade (Ministerie Van Handel),
Exhibitions and Fairs Branch, Lacon House, Theobalds Road, London, W.C.1.

Bofors A.B.,
Tidaholm, Sweden.

Firma J. G. Van Boven,
Schelluinsestraat 16, Gorinchem, Holland.

British Celanese (Overseas) Ltd.,
Celanese House, 22/23 Hanover Square, London, W.1.

British Oxygen Chemicals Ltd.,
Bridgewater House, Cleveland Row, St. James', London S.W.1.

British Plastics Federation,
47–48 Piccadilly, London, W.1.

Buss A.G. Basel,
Pratteln, Switzerland.

Ciba N.V.,
Van der Duyn van Maasdamlaan 2, Arnhem, Holland.

T. H. & J. Daniels Ltd.,
Stroud, Glos.

Handelsafdeling Van G. Dikkers & Co. N.V.,
Hengelo (O), Holland.

Dow Corning Corporation,
Midland, Michigan, U.S.A.

Dowding & Doll Ltd.,
346 Kensington High Street, London, W.14.

Draka-Plastics (N.V. Hollandsche Draad- En Kabelfabriek), Hillegom, van de Endelaan 15, Hamerstraat 10, Amsterdam-N., Holland.

J. C. H. Van Duyl JR,
Mathenesserlaan 243, Rotterdam, Holland.

Dynamit-Actien-Gesellschaft, Vormals Alfred Nobel & Co., Afd. Venditor Kunststoff-Verkauf, Troisdorf (Bez. Köln), Germany.

East Anglia Plastics Ltd.,
Temple Works, Knight Road, Strood-Rochester, Kent.

Technische Handelmaatschappij Edilon N.V.,
Spaarndamseweg 214, Haarlem, Holland.

Electro Zuur- En Waterstoffabriek, N.V.,
Distelweg 90, Amsterdam-N, Holland.

Export Service,
The Hague.

Firma Johann Fischer,
Lohmar (Bez. Koln), Germany.

Maschinenfabrik P. Flesch,
Altenaer Strasse 10–12, Ludenscheid, Germany.

J. Fischer,
Lohmar, Near Cologne, Germany.

Frese & Van Beusekom,
Wagnerkade 41, Heemstede, Holland.

Geveke & Co's Technisch Bureau N.V.,
Postbus 440, De Ruyterkade 113, Amsterdam, Holland.

Granbull Tool Company Ltd.,
39 High Street, Kingston-on-Thames, Surrey.

N.V. Chemische Fabriek v/h Dr. A. Haagen,
Molenweg 10, Roermond, Holland.

Hoechst-Holland N.V.,
Sarphatikade 1, Amsterdam, Holland.

N.V. Houthandel Holland-Triplex Import,
Bredestraat 31, Rotterdam, Holland.

N.V. de Hollandsche Papier Industrie,
Prinsengracht 472–480, Amsterdam, Holland.

Metaalwarenfabriek Hulskamp N.V.,
Frieseweg 47, Alkmaar, Holland.

Chemische Werke Huls A.G.,
Kreis Recklinghausen, Marl, Germany.

Imperial Chemical Industries (Holland) N.V.,
Postbus 551, Wijnhaven 107, Rotterdam, Holland.

Imperial Paper & Color Corporation,
Glens Falls, N.Y., U.S.A.

Internationale Kunststoffen Industrie N.V.,
Voorschoten, Holland.

Isoplex Works,
Kobenhavnsvej 29, Roskilde, Denmark.

Kamphuys & Oosterbaan, N.V.,
Voorburgwal 286, N.Z., Amsterdam, Holland.

J. F. Kenure Ltd.,
Feltham, Middlesex.

Koninklijke Zwavelzuurfabrieken v/h Ketjen N.V.,
Amsterdam, Holland.

Kleestron Ltd.,
West Halkin House, West Halkin Street, London, S.W.1.

Korting Radio Werke GmbH.,
Grassau/Chiemgau, Germany.

Kunststoffeninstituut TNO,
Julianalaan 134, Delft, Holland.

Lacrinoid Products Ltd.,
Gidea Park, Essex.

Van Leer's Vatenfabrieken N.V.,
Stadhouderskade 6, Amsterdam, Holland.

Linoleumfabriek, N.V. Nederlandsche,
Krommenie, Holland.

G. L. Loos & Co.'s Fabrieken N.V.,
Grasweg 54–58, Amsterdam, Holland.

Maxinec N.V. Industriele Apparatuur,
Boterstraat 12, Schiedam, Holland.

Merrem & La Porte N.V.,
Keizersgracht 473–479, Amsterdam, Holland.

Midland Silicones Ltd.,
19 Upper Brook Street, London, W.1.

Milford-Astor Ltd.,
107 Crawford Street, London, W.1.

Soc. Montecatini,
Via F. Turati 18, Milaan, Italy.

Nautamix, N.V.,
Ged. Oude Gracht 144, Haarlem, Holland.

Negri Bossi & Co., Milaan, Italy.

N.V.C.P. (Nederlandsch Verkoopkantoor Voor Chemische Producten N.V.), Mauritskade 63, Amsterdam, Holland.

Organico S.A.,
23 Avenue F. D. Roosevelt, Paris (8e), France.

Owens' Corning Fiberglass Corporation,
Toledo 1, Ohio, U.S.A.

N. V. Peck & Co.,
Nieuwendijk 62–76, Amsterdam, Holland.

Kunststoffenverwerkende Industrie Plasticall, Dr. C. J. K. van Aalstweg, Hoorn, Holland.

Plastima, N.V. Verkoopkantoor van Plastische Materialen en Machines, Hofweg 3, Den Haag, Holland.

Rediweld Ltd.,
17–27 Kelvin Way, Crawley, Sussex.

Van Reekum Papier-Gepacy N.V.,
Hoogtekadijk 43, Amsterdam, Holland.

Firma A. Reifenhauser Maschinenbau,
Troisdorf/Köln, Germany.

Ret, Triplexhandel,
Zeedijk 5, Utrecht, Holland.

Rohm & Haas G.m.b.H.,
Darmstadt, W. Germany.

J. Sandt A.G.,
Pirmasens, Germany.

Saro Laminated Wood Products Ltd.,
Folly Works, Whippingham, East Cowes, Isle of Wight.

Shawinigan Ltd.,
Marlow House, Lloyd's Avenue, London, E.C.3.

Shell Nederland N.V.,
Wassenaarseweg 80, 's-Gravenhage, Holland.

Dr. Ing. Fritz Sommer Nachf.,
Ludenscheid, Germany.

Société Pour Des Métaux Ouvrés Somo,
7–11 rue des Caroubiers, Geneve, Switzerland.

Staatsmijnen in Limburg, (State Mines),
Heerlen, Holland.

R. S. Stokvis & Zonen N.V.,
Postbus 426, Rotterdam, Holland.

Styrene Products Ltd.,
96 Piccadilly, London, W.1.

Synprodo, N.V. Synthetische Producten Onderneming,
Wijchen (N.B.), Holland.

Tavannes Machines Co. S.A.,
Tavannes, Switzerland.

Arthur Ulbrich & Co. N.V.,
3e Kostverlorenkade 1–5, Amsterdam, Holland.

J. H. Vavasseur & Co. Ltd.,
Ceylon House, 15–16 America Square, London, E.C.3.

Firma Weber,
Marniersweg 151, Rotterdam-C., Holland.

Werkmetaal, N.V.,
Achterburgwal 137, Amsterdam, O.Z., Holland.

Werkspoor N.V.,
Oostenburgermiddenstraat 62, Amsterdam, Holland.

West Instrument Ltd.,
52 Regent Street, Brighton 1, Sussex.

Williams (Hounslow) Ltd.,
Hanworth Road, Hounslow, Middlesex.

Wilmod Compagnie N.V.,
van Blankenburgstraat 15, Den Haag, Holland.

R. H. Windsor Ltd.,
Leatherhead Road, Chessington, Surrey.

Zimmer-Bofors N.V.,
Korte Bleekerstraat 1–7, Amsterdam, Holland.

Developments in Expanded P.V.C.

A review of the properties, methods of fabricating, and applications of the unplasticized cellular p.v.c. material recently launched by Whiffen and Sons, Ltd.

AT the British Plastics Exhibition at Olympia last July a newcomer to the field of expanded plastics was shown for the first time. This was ' Fi-Vi,' an unplasticized rigid cellular polyvinyl chloride material manufactured by Whiffen & Sons, Ltd.

Expanded p.v.c. or, for that matter, almost any expanded plastic, is not new and this claim is not made by the manufacturers. They have, for many years, manufactured blowing agents for the expansion of plastics and both natural and synthetic rubbers and it was during the course of development work on expanded material that ' Fi-Vi ' was first made.

Some of the other expanded plastics available today have similar physical properties to ' Fi-Vi.' Not all, but at least one or two are as light. By the Whiffens' process, a fine-celled, light, flexible but unplasticized material is produced with a wide range of industrial applications.

Physical Properties of ' Fi-Vi '

' Fi-Vi ' is expanded by a special process to approximately 35 times its normal bulk. It has a very fine cell structure, the cells being completely non-interconnecting, and has a density of only 2 lb./cu. ft. or 1.5–1.6 lb./cu. ft. with the outer glossy skin removed.

A summary of the physical properties of a specimen of 2 lb./cu. ft. density is given below:

TABLE I

SUMMARY OF PROPERTIES

PROPERTY	UNITS	WITH SKIN	WITHOUT SKIN
Density	g./cc.	0.039	0.032
	lb./cu. ft.	2.4	2.0
Water vapour transmission	g./sq. metre/24 hrs.	2.8	7.7
Tensile strength	lb./sq. in.	121	88
Flexural modulus	lb./sq. in.	3,250	1,510
Compressive yield stress	lb./sq. in.	—	22
Compressive modulus	lb./sq. in.	—	470
Power factor	at 1,600 c/s.	—	0.002-0.02
Permittivity	at 1,600 c/s.	—	1.00-1.12
Surface resistivity	log. 10 (ohm.)	—	12.3-14.9
Volume resistivity	log. 10 ohm.-cm.	—	14.0-15.3
Electric strength	volt./mil.	—	43-90
Heat insulation factor	B.Th.U./sq. ft./hr./°F./in.	—	0.2

Insulation

By virtue of its closed-cell structure, ' Fi-Vi ' possesses excellent thermal insulation properties. When used in refrigeration equipment its non-interconnecting cells do not absorb water or moisture at low temperatures and so prevent the fabric from becoming " ice-blocked." At high temperatures it will withstand heat up to 70° C. without disintegration or deterioration. Between 70°–100° C. it becomes soft and pliable but regains complete rigidity on cooling.

Shock Absorption

In sheet form the material is flexible (although no plasticizer is used in its manufacture) particularly when the outer, highly glossed skin is removed. This flexibility is valuable when working ' Fi-Vi ' into shapes and, whilst it is compressible, it does not exhibit " bounce." It can, therefore, be used to advantage in the construction of vehicle bodies, containers and so forth, that have to be subjected to vibration and shock.

Bonding

When it leaves the mould, sheet material possesses a brilliant, glossy skin which imparts greater rigidity to the sheet, as well as making it more resistant to abrasion. Unless it is required as an exterior finish it can be supplied with the skin removed and the fine cell structure revealed.

By itself, a sheet or plank is quite soft to the touch and is not highly resistant to abrasion or rough treatment. But, when bonded to any one of a variety of materials (wood, aluminium, chopped strand mat, glass cloth, wood-veneer, Formica, p.v.c. sheet, leather cloth, etc.), the assembly possesses great strength and rigidity.

An example of vacuum forming with ' Fi - Vi.' Complex shapes can be easily moulded.

It can be bonded with almost any synthetic adhesive and the closed cell structure that plays such an important part in its flexibility again shows to advantage. It allows no deep penetration of the adhesive and so the very minimum amount is necessary to obtain a strong, permanent bond.

A Chemical Timber

Physically, the material can truly be called a chemical replacement for timber. It can be cut with a sharp knife, sawn, drilled, routed and shaped with conventional timber-working tools. And it can be bent to shape *cold*, even more easily than can be done with wood.

Wood will, in time, rot in water; it will absorb water and it is open to attack from marine life—especially in sea water and warm climates. Moreover, good quality timber is not always easy to obtain and, when found, is by no means cheap. On the other hand, wood-working is perhaps man's oldest known craft. These skills have been nurtured and developed down the years and the switch to plastics, more often than not, has meant abandoning those old skills and learning a whole set of new ones, with new, different tools and equipment.

In ' Fi-Vi,' Whiffens' have produced a material which can be used in the same way as wood, utilizing the same crafts and tools. It differs from timber in that it is much lighter and does not absorb water, so that its dimensions do not vary with moisture content. In other words, it does not swell when immersed in water or contract in a dry atmosphere. Its affinity with a wide range of synthetic adhesives allows sheets or planks of any required length to be fabricated easily and quickly and without any pre-heating treatment.

Scarf joints, butt joints, half-joints are all possible and simply done. Double curvature surfaces can be achieved with an ease of operation not attained with wood.

Strength and Recovery of ' Fi-Vi '

The elasticity and recovery after pressure of the material is excellent. A 3 ft. plank, 1 in. thick, can be bent by hand through 180° without cracking or splitting and will recover its normal shape when released. Table 2 shows the effect of pressures on

floats moulded in ' Fi-Vi.' Even after severe testing, there was no irreversible collapse of the cell structure but at pressures greater than 125 p.s.i. there is a sudden and marked decrease in volume. When pressure is reduced to atmospheric, volume recovery almost 100%.

TABLE 2

Weight of float at atmospheric pressure 0.891 oz.
Buoyancy " " " " 7.375 oz.
Volume " " " " 14.3 cu. in.

Pressure Applied p.s.i. for 13 min.	Depth of Sea Water Fathoms	Reduction in Volume Cubic Inches	Actual Volume under Pressure Cubic Inches	Buoyancy Ounces
25	9⅜	0.165	14.135	7.262
50	18¾	0.180	14.120	7.253
75	28⅛	0.210	14.090	7.236
100	37½	0.240	14.060	7.219
125	46⅞	0.285	14.015	7.193

The weight of the float after test, 0.891 ozs. indicates that there is no penetration of water into the cell structure.

Industrial Uses

The foregoing briefly and simply outlines the general properties, the nature of this new expanded p.v.c. Applications in the industrial world are obvious. It commends itself for use in sandwich constructions where a high strength/weight ratio is important. Its affinity with a variety of synthetic adhesives permits strong, rigid laminates with all manner of surface finishes to be accomplished simply and quickly.

Perhaps one of the most outstanding characteristics is the self-buoyancy obtained. It is indeed unsinkable and so becomes of paramount importance in the manufacture of products for the marine world. At the British Plastics Exhibition last July, Whiffens' showed the unfinished hull of a prototype power launch constructed throughout of nothing more than ' Fi-Vi ' planks, sandwiched between sheets of glass cloth and bonded together with synthetic resins.

The result was a not unhandsome, light hull (it weighed only about 300 lb.) which was completely self-buoyant. Tests on the Thames had shown that it refused to founder, even with two men weighing together 25 stone aboard, and the bung removed. With the " live weight " removed, the boat proceeded to empty itself !

Repairs to a hull of this description present no difficulties. A piece of ' Fi-Vi ' shaped with a knife, an application of resin and a patch of glass cloth would be sufficient to repair any perforation of the hull, no matter how deep or jagged.

Other items of marine buoyancy immediately come to mind. Life jackets, buoyancy blocks, mooring buoys are all possible or, more appropriately, probable with this new unsinkable material. The safety aspect will appeal to constructors not only of ship's life-boats but of almost any and every craft. A hull constructed of a sandwich of ' Fi-Vi ' and glass cloth, fabricated by traditional wooden boat building methods should appeal to many. No buoyancy tanks to risk puncture; no space wasted in the construction of such, and permanent, corrosion-resistant, buoyancy.

Also exhibited alongside the boat hull was a selection of fishing floats all moulded in this new expanded plastic. Reports indicate that Whiffens' have developed the almost perfect herring drift-net float. Brightly coloured and indestructible, they have withstood pressures up to 125 lb./sq. in. (equivalent to a depth of 50 fathoms) without any loss of buoyancy. Other types of float are in process of development. Purse-seine floats, inshore-trawler floats and many others are already being made in test quantities.

No less interesting is the use of planks or sheets in the manufacture of strong, rigid laminates for the construction of refrigeration equipment and insulated vans and containers. The thermal insulation properties of this fine-celled material make it ideal for this purpose.

Lightweight, highly decorative and strong internal partitioning is another outlet. In this case, the final glossy skin of the plank is sliced off thinly to allow better lamination and the economic use of resin adhesive. If this skin is retained the plank is sufficiently rigid and strong to be used as a decorative panel or ceiling that will require no further painting or finishing to present a permanent, brightly coloured face. Moreover, the colour extends right through the body of the plank, so eliminating any risk of unsightly peeling-off of the top coat.

It is not possible to assess, in one article, all the varied and probable applications for which a material such as ' Fi-Vi ' is suitable. There is a vacuum-forming, for example. Tests have shown that thin sheets of the material, by virtue of the thermoplastic nature of the non-porous fine cell structure, can be formed into quite complex shapes.

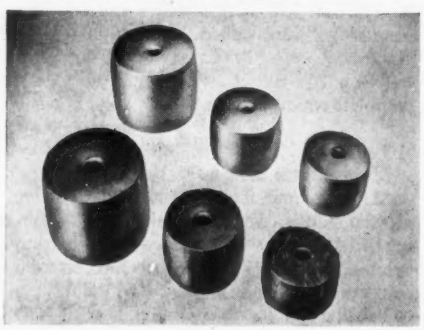
This suggests uses not only for display purposes, but, with the permanent deep-through colouring available with ' Fi-Vi,' decorative designs are possible.

And so the possibilities accumulate for a material that is really something new in expanded plastics. Briefly summing up: ' Fi-Vi ' is very light and, for its weight, extremely strong. It is flexible and will easily conform to a required shape. It can be used with simple, conventional tools—knives, saws, routers, drills.

It can form the heart of strong, rigid, lightweight, fabrications that are proof against dry- and damp-rot; corrosion, shock and vibration. The products so made have all the rigidity of constructions made in other materials but less, far less of the snags.

The manufacturers themselves have not yet fully explored all the material's possibilities. But as development continues it seems, at any rate at first sight, that there is a great future for a material that may well be called " chemical timber."

(Left) The use of ' Fi-Vi ' in planking a hull. Boats made of this material are self buoyant, and even when holed will not founder.



(Right) ' Fi-Vi ' fishing floats. The top row are new floats, and those underneath illustrate the recovery after being subjected to 20 hours continuous pressure at 1,000 p.s.i.

New Productions

All Polythene Cistern

To meet the growing demand from trade and public alike Fordham Pressings Limited of Wolverhampton have produced the " Eternum " a unique lightweight unbreakable white plastic cistern.

This new cistern has been produced after extensive research and it is particularly fitting that this new development should have been made by Fordham Pressings Limited, Dudley Road, Wolverhampton, who were the first with the seamless steel cistern 25 years ago, and who have pioneered and perfected many developments in cistern manufacture. The Fordham " Eternum " is light in weight, only 6 lbs. completely equipped. It is moulded from the new high density polythene which makes it incorrodible, tough, resilient and will withstand any climatic conditions.

The " Eternum " is equipped as standard with the Fordham all polythene syphon and ball float and the Acquasave all polythene ball valve. Even the lever is of polythene thus making the " Eternum " the first ever complete all polythene cistern.

Foamed-in-place Building Insulation

An insulating technique offering potentially large savings to builders, particularly of prefabricated structures, uses Union Carbide phenolic resins that are foamed in place. Using this new technique, chemists at Union Carbide Corporation have succeeded in producing fast-setting foams of uniform density within tall, narrow cavities that simulate the space between studs in a wall.

This technique is significant because the total materials' cost of foamed phenolic insulation is relatively low. With a foam-in-place technique for converting the liquid resin into a foam of 200 times greater volume, there can be additional savings on shipping and installation costs to put phenolic foam in the price range of the lowest-cost insulation materials now on the market. At the same time, insulating properties of phenolic foam at a density of about 2 lb. (.9 kg.) per cubic foot (.3 cu. m.) compare favourably with the most expensive insulating materials available commercially.

The new insulating technique puts to use the well-known foaming properties of phenolic resins when mixed and poured into the cavity and the foam hardens into an infusible cellular structure almost instantaneously.

The complete reaction from mixing to permanent foam is completed in about 60 seconds. The key to successful foaming in a tall narrow cavity is achieving the proper speed or reaction. The foam must set as it rises otherwise density might vary from top to bottom or the cavity might not be completely filled. Additional information can be obtained by writing to the Plastics Department, Union Carbide International Company, Division of Union Carbide Corporation 30 East 42nd Street, New York 17, N.Y., U.S.A.

Polystyrene guitar moulded by Thames Valley Moulders Ltd. for Selcol Products Ltd.

Plastics Guitar

A new guitar made entirely from plastics materials is now being marketed by Selcol Products Ltd. (Charing Cross Road, London, W.C.2).

The guitar, which is 31 in. long, is moulded by Thames Valley Moulders Ltd., of Braintree, Essex, using Styron 475 polystyrene. Polystyrene, like wood, gives the required degree of resonance and the tone of the instrument is superior to that of many of a similar type.

To obtain correct resonance and maintain the essential qualities of a guitar it is necessary to mould and assemble the components with the greatest accuracy.

The neck, the body and tailpiece combine to take the considerable strain of the strings. Unlike its wooden counterpart the neck of the polystyrene guitar does not bend or warp with continual use.

The autochord is an unusual feature of the instrument. For it to function successfully precision moulding of the autochord parts is vital.

The lettered buttons on the autochord correspond to basic chords which are played automatically when a button is pressed. This simplifies playing and provides an easy way of acquiring the rudiments of music.

Densified Wood Laminate Flooring Material

Now available in this country for the first time is a laminated wood flooring called " Permadec," a material originally developed on the continent where it has been in use for more than 20 years. It is manufactured and sold in this country by Permali Limited of Gloucester who have concentrated on making densified wood laminates to technical specifications for the electrical industry. This flooring offers a comparable product and is designed specially for applications requiring a head-wearing plastic material that still retains the pleasing appearance of natural wood.

Densified wood flooring made by Permali Limited.

It is the colour of deep mahogany and the top side of each sheet has a grooved or chequer plate surface. The material is made by impregnating beech wood veneers with phenol formaldehyde resins which are then hydraulically compressed under great pressure and temperature into a homogeneous sheet. The result is a flooring that is simple to lay, easy to maintain and economical to use—it has a very long life compared with traditional forms of construction such as wooden slats and combinations of sheet steel, cork, linoleum or rubber. It can also be re-used or modified without difficulty.

Metallized T Sections

Creators Ltd., of Sheerwater, Woking, Surrey, have recently introduced metallized sections. These sections consist of a covering of cellulose acetate butyrate with an inlay of metal foil, giving the effect of normal chromium or brass mouldings.

In order to ensure the practical serviceability of these sections, it was necessary to develop and use special raw materials, thereby ensuring that, even when they are used in the open air, no yellowing or dulling of the material takes place, as a result of exposure to light, sunshine or rain, providing that the exposed ends are made airtight with a suitable adhesive, which can be supplied by the company. The material will not be affected by temperature up to 85° C. and will only become brittle at temperatures below — 30° C.

(Left) Elektrisk Bureau A/S, of Oslo, have recently introduced a new cream coloured injection moulded telephone into their range. The housing, handset, dial wheel and certain other parts are moulded in Styron 475 toughened polystyrene supplied by British Resin Products Limited.

(Above) A flexible plastic manometer made by Rediweld Ltd., of 17/27 Kelvin Way, Crawley, Sussex. Besides being unbreakable it is simple to transport, fix and use.

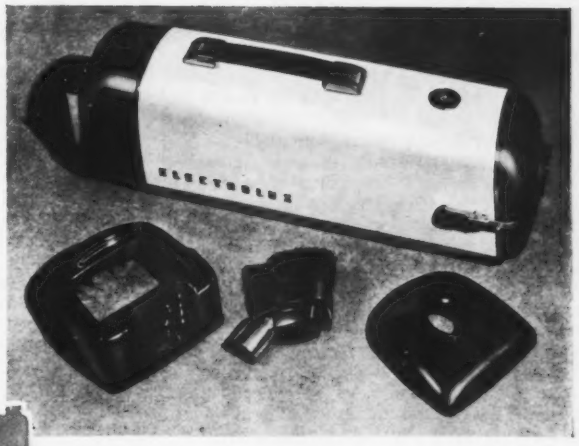
(Right) The Phoenix Assurance Company are now issuing their life policies in Diothene pockets, instead of the more usual paper ones. These pockets, made and printed in one colour by The Metal Box Company, bear the well-known emblem depicting a phoenix rising from the ashes, and the motto " Protection," as well as instructions about the policy.

(Above) Marzipan fruits for the Christmas market are being packed in Bubblepaks by David London Ltd. The Bubblepak which is of card and vacuum formed acetate protects the fruits and provides a hygienic point of sale display pack. Bubblepaks are distributed by Gordon & Gotch Ltd., Farringdon Street, London, E.C.4.

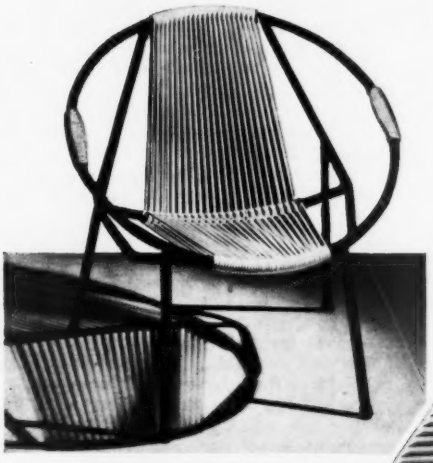
(Above) Clear tubes extruded of Tenite butyrate plastic are now used as covers over fluorescent lamps in factories and laboratories, to help prevent hazards arising from lamp breakage or explosion.

(Left) A low-cost gramophone record made from transparent cellulose acetate only 0.003 in. thick is now available in Great Britain. Facilities have already been installed by the packaging firm of E. S. & A. Robinson Ltd., Bristol, for their attachment to most mass-produced carton sizes in current use.

Installed by Everest Plastics Ltd., 45–46 Morley House, 320 Regent St., W.1, the new process uses a specially-designed press which can print the microgrooves at 400 lines to the inch.



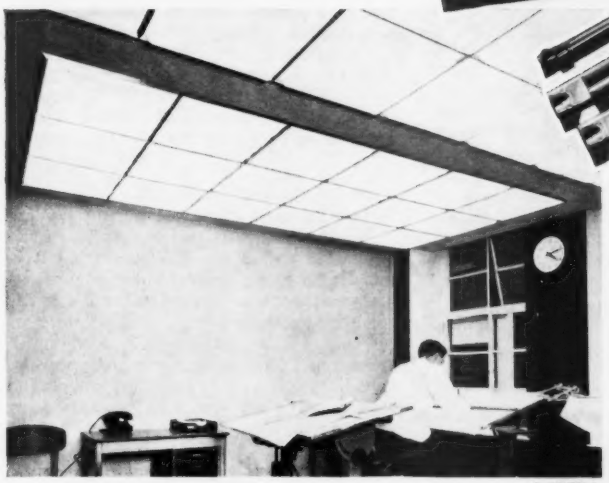
(Right) The model 62 suction cleaner produced by Electrolux Limited which incorporates a front end cover and filter housing moulded from Bakelite phenolic material grade X20/5 green and a dusting brush nozzle injection moulded from Vybak VX304/1 green p.v.c. compound. The two phenolic components are light, strong and durable while the dusting brush nozzle cover, being flexible, will not mark or damage furniture or paintwork.



(Above) From the new range of Boulevard furniture—a circular chair with tubular steel frame, enamel-finished black or white, laced with plastic cords having an insert of rubber and available in a range of gay " glow " colours. Made by W. Lusty & Sons Ltd., Bromley-by-Bow, London, E.3.

(Left) This guard is produced by Startrite Sales Limited, Gillingham, from Bakelite polyester resin reinforced with glass fibre material and is used on a high speed band saw. The advantages of polyester/glass in this application include lightness, strength and resistance to corrosion, as well as a substantial reduction in the vibration and noise experienced with conventional metal guards.

(Below) Vacuum formed polystyrene sheet used for packing and protecting the Radisil heater element.



(Above) A demonstration installation of the new Lumenator Module lighting system, produced by Lumenated Ceilings Ltd., Alliance House, Caxton Street, London, S.W.1, using plain acrylic plastics diffusers. Some of the decorative vinyl plastics diffusers can be seen at the top of the picture.

(Below) Greenhouse glazed with Union Carbide polyethylene film. These greenhouses have withstood gales of up to 80 m.p.h. and supported up to 18 in. of snow covering. Under strong sunlight the film oxidizes and becomes brittle and should be replaced once a year but despite this the cost is still considerably lower than for the initial construction and upkeep of a conventional greenhouse.

World's Industry Employs Plastics

MATERIALS

Thermally Stable Elastomer

A DESCRIPTION of the preparation properties and processing of a new synthetic rubber known as Viton A is given. This new material is a copolymer of vinylidene fluoride and hexofluoropropylene and molecular weight as high as 150,000 have been reported. The copolymerization is carried out at temperatures up to 100° C. utilizing as catalysts system a mixture of persulphate and a bi-sulphite. Viton A may be successfully cross-linked by means of peroxides, high energy radiation and some polyfunctional amines. Besides good resistance of heat this new copolymer is unaffected by the action of lubricants, fuels and hydraulic fluids and it is expected to be of interest for aircraft applications.
(*Ind. Eng. Chem.*, 1957/Oct./1687.)

Improved Clear Plastic Sheet

AN improved clear plastic, Homalite CR-39 is said to have 30 times the resistance to abrasion of methacrylate and is unaffected by any known solvent. It will withstand constant temperatures up to 200° F.
(*Design News*, 1957/Sept. 1/99.)

Polyethylene in Rubber Compounding

THE application of low molecular weight (1,500 to 2,000) polyethylenes in rubber as processing aids and lubricants is discussed in an article by T. A. Bulifant. From two to five parts of polyethylene provide a marked improvement in processing properties, particularly in the modification of tack without adverse affect on adhesion, better mould, flow and release properties and the reduction of mixing cycles. The affect of these materials on the synthetic elastomers as well as natural rubber is given.
(*Rubber Age*, 1957/Oct./89.)

Recent Developments in Polyamides

REICHOLD in a communication from the Technical Applications Laboratories of the Bayer A.G. briefly reviews some new developments in the field of the polyamide resins. Thus, in the case of polyamides for injection moulding, whereas it was formerly necessary to use parting compounds on the dies in order to prevent adhesion, moulding formulations are now available containing additions which render them non-wetting to the die surface; at the same time such additions improve the flow of the resin in the die and result in a moulding with better surface finish. A further improvement has resulted in the developments of injection moulding resins of this group possessing an entirely uniform, finely crystalline structure. These resins are characterized by the rapidity of their solidification, thus they improve production and output. Again, although normal polyamides possess considerable form strength above 100° C. nevertheless their chemical resistance tends to drop at these temperatures. Resins are now available which contain additions ensuring that the resistance to oxidation of the finished mass is many times greater than that of the untreated resin. Transparent polyamides may now be obtained which structurally, may be likened to the silicate glasses in that they consist of super-cooled liquids. It is, however, necessary to observe that in order to obtain complete transparency in these materials, chilled tools must be used and the wall thickness of the moulding must be maintained as thin as possible. Materials in this form are essentially non-crystalline and therefore have a higher flexibility than the normal resins and this factor must be taken into account in design. In order to render polyamide resins suitable for working in extrusions machines or for the production of blown forms and for conversion to wide, thin sheet, it is necessary to produce them in a form in which the sharp melting point of the normal resins is substituted by a melting range, thus rendering it possible to obtain a melt of high viscosity. Resins possessing this property are now on the market. In order to be able to obtain injection mouldings in these special forms of polyamides, the development of special injection moulding machines will be required. Where flexibility is a special requirement of the polyamide, as for example in the case of sheathing for wire which must undergo prolonged alternate bending, or where translucent thin sheet must be obtained (as for example as required for raincoats), suitable plasticized forms of the resin must be used and these are now available. It is also possible to obtain the resins with high pigment contents, although it should be noted that these additions affect both the flexibility and the water absorbtion of the material. Soluble polyamides are now available for impregnation purposes.
(*Chemische Industrie*, 1957/Oct./473.)

Irradiated Polythene

LEEUWERIK AND HEYBOER present an illustrated account based largely on data from Mullard Limited, and from the Stanford Research Institute, on the history and technique of research on polythene irradiation. Particular attention is devoted to the increased resistance to flow at elevated temperatures which may be obtained by irradiating polythene, and apparatus and operating conditions for treatment are described. Reference is made to "Hyrad," the trade name of irradiated polythene produced by the Sequoia Process Corporation of America. Some observations are also made on the effects of irradiation on the mechanical properties of the polythene insulation of electrical conductors.
(*Plastica*, 1957/Oct./686.)

TESTING

Testing Combustibility

THERE has recently been issued in Holland a Standard Specification (3131–57 Plastieken) covering a definition of and method for, determining the resistance to combustion of thermo-setting plastics. Reference is made to the agreement of this Standard with the draft proposal ISO/TC 61 (Plastics) of the International Organization for Standardization.
(*Plastica*, 1957/Oct./684.)

Insulation of Silicones

ROGER MERCIER of the Rhone-Poulence Company, Paris, recently presented a paper at the Silicone Convention of the Electrotechnical Association in Vienna on the uses of the Rhodorsiles in low and high frequency electro-technology with special reference to cable manufacture. He refers to the use of silicone elastomer sheaths with a wall thickness of 0.2 mm. for canning condensers, and notes also the use of silicones for insulating the electrodes in high frequency appliances for plastic welding, the use of the silicone here also helping to prevent adhesion of the electrode to the surface being welded. For cable sheathing, the low dielectric loss and high resistivity of the silicones as well as their relatively low combustibility and low water absorbtion have resulted in their being used for numerous purposes, such as sparking plug leads for aircraft, telephone cable, cable for lighting equipment in offices and drying chambers, electrical leads for heating elements and underwater cable. If a silicone covering burns, SiO_2 formed, still retains insulating properties. It is noted that cable insulated with silicones weighs 20 per cent. less and has a volume of 30 per cent. less than for similar cable insulated with the customary materials. The author notes the use of silicone closures for immersion heaters.
(*Der Plastverarbeiter*, 1957/Oct./362.)

Plastic Model for Structural Strength Tests

AN all-plastic model of a car three-eighths normal size has been used by Chrysler Corporation to check data on structural strength of body shells. A one ounce load on the model is equal to 35 lb. applied to the steel equivalent.
(*Design News*, 1957/Sept. 1/5.)

MACHINERY

Production of Plastic Foils

NEWER types of calender for the production of plasticized and unplasticized p.v.c. film are described by W. Raderhaus. It is indicated that the 4-roll calender is preferred and the author considers the merits of different roll arrangements referring, in illustrations, to machines by Kleinewefers. Consideration is also given to the requirements and operating conditions of modern ancillary plant for supplying the calender. In conclusion an account is given of a double worm feed extrusion press.
(*Plaste und Kautschuk*, 1957/Sept./327.)

Calender Design

AN account of the design and engineering requirements for the production of thin plastic films with special reference to the growing demand for thinner and wider foils of increasingly fine surface finish. K. J. Gooch, the author, presents a mathematical analysis of certain fundamental requirements and illustrates his work with a number of useful graphs

and diagrams. Attention is devoted principally to the "Z" type, inclined, four-roll calender. (*Materie Plastiche*, 1957/Sept./729.)

TECHNOLOGY

Proficiency in Plastic Welding

A SUMMARY by W. Schrader of the requirements for certificates of proficiency in the welding of p.v.c. It is noted that the commercial value of this qualification is rapidly attaining the same level as that of a certificate for proficiency in metal welding.
(*Plaste und Kautschuk*, 1957/Sept./325.)

Glass Fibre Reinforcement

GLASS fibre in whatever form, treated with unpolymerized resin, although at first not visible in the mass, tends to become visible after polymerization due to shrinkage of the plastic away from the glass surface. If, however, the glass is first wetted with a small quantity of the resin so as to give a thin film around each fibre, this being afterwards polymerized, then the effect of contraction will be to produce tight resin skins round the fibres. Subsequently, when the glass reinforcement so treated is embedded in the final resin mass, shrinkage effects, if they occur, will no longer render the fibres visible.
(*Der Plastverarbeiter*, 1957/Oct./378.)

Problems in H.F. Welding

JOHANNES LINKE discusses the economy of the dielectric heating method for the welding of plastics and points out that many of the special applications of this process demand, initially, close co-operation between manufacturers and users; no universal solution is available for every problem. The author briefly considers the basis of the design of the welding machine particularly with respect to control of the high frequency field by suitable arrangement of the electrodes. Elementary mathematics governing the dimensions of electric leads from the generator to the electrodes are presented, reference being made to paraemeters for leads of copper, aluminium and brass. The author also notes that advantage may be taken of the skin effect with high frequency currents by the application of suitable electro-deposits to the electrodes.
(*Der Plastverarbeiter*, 1957/Oct./377.)

Polyamide Injection Mouldings

CERTAIN difficulties associated with the injection moulding of polyamides and with the replacement of metals and other structural materials by polyamide injection mouldings are touched on. It is noted that the fully automatic injection moulding machine can only be used for certain simple types of polyamide injection mouldings. The author analyses in detail the respective requirements for fully or partially automatic operation, and goes on to show that in certain circumstances the hand-operated machine can have advantages. The need for careful stocking of the resin and for its complete dryness prior to moulding are stressed and it is emphasized that test mouldings must be made and carefully examined before production is undertaken. The requirements of inspection are outlined. A system is described whereby mouldings are extruded at various stages between the commencement and the end of the moulding process and examined stage by stage for possible defects, such defects being corrected, equally, stage by stage. The author concludes with a discussion on the best method of dealing with "burning" and finishes up by stressing the need for accurate temperature control and good sprues to the dies.
(*Der Plastverarbeiter*, 1957/Oct./371.)

Faults in Phenolic Mouldings

THE causes of failure of two phenolic-resin transfer mouldings, both containing metal inserts, are analysed by Thater. The phenomena of expansion and contraction exhibited by the component during and subsequent to the moulding cycle are examined, and a procedure is outlined to avoid the occurrence of local high stressing with subsequent cracking. The author concludes with a lengthy tabular summary of the types, causes and means of avoiding faulty mouldings.
(*Plaste und Kautschuk*, 1957/Sept./Supplement No. 4 (facing page 344) page 13.)

Curing of Epoxy Resins

A SIMPLE and rapid method is described in which infra-red spectroscopy is used to follow the decrease in the epoxy content of an epoxy resin as it is cured. The technique is used to compare the activities of diamines as curing agents.
(*J. Polymer Sci.*, 1957/Aug./351.)

Polymerization of Styrene

IT has been found possible to control the time of growth of polymerizing styrene radicals by adding overwhelming amounts of free radicals at intervals to an emulsion polymerization system. Polymers with the molecular weights of most of the molecules very narrowly concentrated around selected values can be prepared in this way. The upper limit of the molecular weight obtainable is determined by the rate of chain transfer. For styrene at 0° C. this upper limit appears to be a few millions.
(*J. Polymer Sci.*, 1957/June/27.)

APPLICATIONS

Packaging in Italy

A REVIEW by P. Crocella of the Sixth Packaging Exhibition at Padua, May 29/June 13, 1957. After a brief introductory account outlining the advantages of plastics for packaging, the author presents a stand by stand summary of the most important exhibitors including Soc. Montecatini, Milan; Pirelli S.p.A., Milan, SESI, Milan; Darex Italiana, Milan; Soc. Nestpack di Bologna; Mostra Specializzata, Austriaca (Austria); Alphania di Milano; Triulzi di Milano. Each company's exhibit is typified by an appropriate illustration of the stand concerned. A few non-Italian exhibitors are referred to.
(*Materie Plastiche*, 1957/Sept./699.)

Plastics in Agriculture

AN account by R. Pozzo of specific applications of plastics in the economy of agricultural engineering and construction, reference being made to examples both in Italy and abroad. The use of polythene sheet for lining reservoirs in order to conserve water in otherwise unfavourable terrain is noted and illustrated with some working details. Applications of corrugated, glass-fibre-reinforced polyester resin sheet (Vetroplast) for the walls of an experimental greenhouse by Montecatini are illustrated and described. Polythene- and p.v.c.-glazed greenhouses are also shown. Polythene-film (Pirelli-Plast)-covered lids to concrete bunkers and modified cloches consisting of Pirelli-Plast polythene sheet on a wooden frame, form the subject of further illustrations and descriptive matter, together with a table showing light transmission for various wavelengths through various types of plastic. Silos, enclosures for silage and barns and similar structures are also dealt with in considerable detail.
(*Materie Plastiche*, 1957/Sept./715.)

Domestic Market Survey

PRESENTING the results of a survey conducted over a representative cross-section of housewives in Vienna by the "Institut für Markt-und Meinungsforschung, Dr. Walter Fessel." Various income groups are tabulated and each of these is then analysed on a percentage basis with respect to the possession or non-possession of the following plastic items:—(1) handbags; (2) curtains; (3) tablecloths; (4) wall hangings; (5) furniture coverings; (6) brief cases and purses; (7) shopping baskets and the like; (8) kitchen ware and crockery; (9) jugs, beakers, measuring glasses; (10) brushes. To each classification is appended, first, a percentage analysis of satisfied, unsatisfied and indeterminate possessors of these items and, secondly, a list of advantages and disadvantages of each group as revealed by questioning the owners. A final analysis, based on × 100 as representing entire satisfaction, and —100 as entire dissatisfaction, of each group reads as follows:—brushes, +89; wall hangings, +88; crockery, +83; furniture coverings, +78; kitchen ware, +76; purses, +76; tablecloths, +70; curtains, +67; brief cases, etc., +60; handbags, +59.
(*Osterreichische Plastic Rundschau*, 1956/Dec./53.)

Aluminium and Plastic in Venetian Blinds

AN advertisement for Berni (Florence) venetian blinds, emphasizes the advantages of the combination of aluminium slats for flexibility, linked by plastic bands which are easily cleaned by wiping with a damp cloth. The type of plastic used is not indicated.
(*Rassegna Tecnica*, 1957/May/35.)

Shop Window Frames and Glazing

A SHORT summary with numerous sectional diagrams of framing sections for shop windows in Mipolan. The mechanical strength and non-ageing characteristics of the plastic are noted together with the fact that these materials are easily kept clean by occasional washes with cold or warm water. Mipolan framing may be used wherever the use of metal or wood framing is permissible. In the same periodical is an interesting note on a "provisional glazing" developed by a company in Westphalia under the name "Cedra-Drahtrollglas." It is available in rolls from 25 metres long and 1 metre wide and is recommended for the weatherproofing of partially completed buildings (i.e. for temporary closure of window cavities and the like) where interior work must be carried out during cold and inclement weather. It is translucent, unbreakable and readily washed with warm water or neutral soaps; no other details are given as to the nature of the material.
(*Das Bauwerk*, 1957/August/243; 245.)

Plastics News

Plant and Equipment, Materials, Processes, Company News, Technical Literature, Exhibitions, Personal Notes and Meetings.

NEW LOW-COST ACCELERATOR FOR INDUSTRIAL PROCESSING.—A new model Van de Graaff particle accelerator just announced by High Voltage Engineering Corporation, Burlington, Mass., will enable in-line radiation processing in certain industrial applications where, until now, it has been economically impractical.

The model GS, a 1.5 million-volt machine, will produce ionizing radiation for under $20,000 per kW and is the most inexpensive particle accelerator presently available for in-line processing use. Development of this new radiation source was aimed specifically at extending the practical range of Van de Graaff particle accelerators in industrial treatment of films, sheets, wire, liquids, gases and powders —areas where radiation cost per kilowatt has heretofore been prohibitive.

According to High Voltage officials, the low-cost accelerator is rated at 2.5 kW for industrial operations but will provide peak power of 4–5 kW. Considerable research was directed toward development of an electron energy output which would provide effective treatment in the widest possible range of known or potential applications. The 1.5 million-volt beam was thus selected as the most practicable.

The new Van de Graaff is compactly designed. The electron beam is scanned through a thin aluminium window located just 66 in. below the unit's base plate, making installation possible in minimum space. DC in nature, the ionizing radiation can be accurately controlled and monitored.

The Powell Vertolifter hydraulic lifting truck.

DEEP HOLE DRILLING WITH INCREMENTAL FEED.—This new development from Pacera has been specially designed for use with existing drilling machines when the drilling of deep holes is required.

With the equipment illustrated the progressive forward movement of the drill and its periodical retraction are controlled by an electrical cyclic timer with variable controls.

The periods during which the drill either feeds or retracts are independently variable over the range 1½/60 seconds (other ranges available if required). For example, a drill may be timed to advance for 3 or 4 seconds and retract for 1½ or 2 seconds, and then continue this cycle until the drilling is completed.

This method of "relief" drilling makes use of a Special Air Hydraulic Feed Unit, which provides fast approach and fast retraction of the drill during the complete drilling cycle; it also allows exactly the right cutting speed to be chosen for the drill in use.

Further details can be obtained from W. J. Meddings Ltd., 16 Berkeley Street, London, W.1.

General

Japanese Import Quotas.—Notices to Importers Nos. 813, 816 and 826 announced the quotas for the import of goods from Japan which has been established under the general Trade Agreement between the United Kingdom and Japan for the period ending September 30, 1957. These arrangements have now been extended for six months to March 31, 1958, and the various quotas will therefore be increased by one-half over the amounts originally fixed, with the exception of canned tuna and salmon.

Importers at present holding licences to import goods under them may now apply for supplementary licences to a value not exceeding 50% of the value of their current licences.

In the case of plastics materials, applications need not be restricted to 50% of the applicant's current licence. Applications may also be considered from traders who do not at present hold a licence.

Applicants should note that the scope of Quota No. 24 (Plastic Materials) has been extended to include a limited quantity of polyvinyl alcohol.

Transfer of Production Responsibilities.—From December 1, 1957, production responsibility for builders' hardware, plumbers' hardware, cooking, heating and lighting equipment and a number of allied materials has been transferred from the Ministry of Works to the Board of Trade.

The Ministry of Works will continue to be concerned with the problems of the building industry as a whole and will retain a general interest in all building materials and components; they will also continue to deal with specific problems relating to: floors and floor surfacing materials of plastic and rubber. Glass fibre. Plastic sanitary ware (including plastic flush pipes and W.C. seats). Wall and hearth tiles of plastic. Floor tiles of rubber and plastic (including "composition" and vinyl-asbestos).

The Pacera drill control cabinet for deep hole drilling.

Colours for rigid sheet.—A new range of Cerric acrylic colours for application by silk screen, spray gun or brush have been developed by Cellon Ltd., Kingston-on-Thames, in conjunction with I.C.I. Plastics Division. Principally designed for use with Perspex sheet they have been found to give excellent results with other rigid sheet materials.

Hydraulic Elevator Truck.—The latest addition to the Powell "Vertolifter" range of hand operated hydraulic elevator trucks is the Model VTR/30.

This model incorporates the new size platform, 20 in. long × 21 in. wide and is available with two heights of lift, 48 in. and 60 in.

The model is robustly constructed using steel sections of adequate gauge and design for the load capacity of 500 lb. All moving parts have either ball or roller bearings. The hydraulic pump is double acting and finger tip control permits the load to be lowered swiftly or slowly with instant stopping at any point. Further details can be obtained from Powell & Co., Burry Port, Carms., South Wales.

Spark Machining.—The rapidly developing technique of spark-machining is the subject of a new 16 mm. colour film, "The Wickman Erodomatic," produced by Wickman Limited, of Coventry.

The film, which runs for about 17 minutes, begins with an animated sequence showing the nature of spark-machining, and illustrates the equipment necessary for the process with a description of the two Erodomatic models currently available.

Copies of the film, which carries a fully

descriptive commentary, will be available for loan in the near future, and a companion booklet is in course of preparation.

"Fluon" Spray Coating Dispersions.—Imperial Chemical Industries Limited, Plastics Division, have now added a number of spray coating dispersions to their "Fluon" p.t.f.e. range. P.t.f.e. is the best of the non-stick materials and its very low coefficients of static and dynamic friction are equal and about the same as wet ice on wet ice.

Available at home and overseas, the dispersions comprise: "Fluon" p.t.f.e. dispersion Primer PI (Solution A), Acid Solution B (for use with "Fluon" p.t.f.e. Dispersion Primer PI), "Fluon" p.t.f.e. dispersion Clear FI, "Fluon" p.t.f.e. dispersion Black FI, "Fluon" p.t.f.e. dispersion White FI.

The dispersions can be applied by spraying, dipping or brushing to a wide variety of materials, such as metal, glass and ceramics.

Plastic Buffing Compound.—A new high colour buffing compound for scratch-free finishing of all plastics contains a special ingredient that imparts anti-static properties to the part being finished, according to an announcement from Hanson-Van Winkle-Munning Co., Grand Rapids, Michigan, U.S.A.

The new buffing compound, called PC-93, was specifically formulated for high-colour buffing of thermoplastic materials, since these plastics present greater problems with static electricity. It is also reported that PC-93 has also provided high-colour finishes on thermosetting phenolics in initial field installations.

Anti-static properties imparted by PC-93 will be retained through an extensive series of subsequent handling operations.

U.S.A. Garden Hose Standard.—Plastics garden hose now has a standard in the U.S.A. which assures the consumer of its quality. The manufacturing standard, covering vinyl chloride plastics garden hose, was sponsored by The Society of the Plastics Industry, Inc. and has been issued by the United States Department of Commerce.

Prepared and approved by the garden hose manufacturers and major consumers throughout the country, the Commercial Standard CS209–57 incorporates a Seal of Quality which may be displayed on plastics garden hose meeting the requirements of the standard.

Anti-oxidant.—Monsanto Chemicals Limited announces that it is now producing in this country Santovar A, as an anti-oxidant for unvulcanized rubber. In the past Santovar A has been available only from the United States.

It is non-staining, and its main use is in the manufacture of adhesive plasters, insulating tapes and other pressure-sensitive tapes.

Exemptions from Key Industry Duty.—The Treasury have made an Order exempting the following articles from Key Industry duty for the period beginning November 19, 1957, and ending February 18, 1958.

Synthetic organic chemicals, analytical reagents, other fine chemicals and chemicals manufactured by fermentation processes, the following:—Ethyl lactate (an ethyl ester), Maleic acid, Maleic anhydride, Methyl reserpate *O*-ethoxycarbonylsyringoyl ester (a methyl ester), Phthalic anhydride.

Design Corporation.—The Design and Research Centre for the Gold, Silver and Jewellery Industries, St. Dunstan's House, Carey Lane, Cheapside, London, E.C.2, has organized a design competition for Souvenirs and Jewellery.

The stand of Formica Ltd. at the Building Exhibition.

The prizes will be awarded for seven sections including, costume jewellery, fancy goods, and souvenir goods. Closing date is February 28, 1958.

International Standards for Plastics Pipes and Fittings.—Special importance is now attached to international standardization for plastics pipes and fittings in view of the European free trade area possibilities and Mr. D. Sullivan, of Melwood Thermoplastics Ltd., who led the British delegation to the International Standards Organisation, states that progress is being made and task groups set up to finalize details of sizes and pressure ratings for adoption at the next meeting.

Exhibitions

Plastics 1959.—The International Plastics Trade Fair is to be held in Dusseldorf/Germany from October 17 to 25, 1959.

International participation will not, this time be restricted to the machinery and accessories industries but will include the plastics producing and plastics processing industries.

The Fair will be organized by: The German Plastics Federation, Frankfurt/Main, in cooperation with the Association of Manufacturers of Machinery for Processing Rubber and Plastics and the Association of Manufacturers of Cutting and Punching Tools and Tools for the Manipulation of Plastics, Frankfurt/Main.

The technical organization of the Fair is in the hands of: Nordwestdeutsche Ausstellungs-Gesellschaft GmbH. (NOWEA), Dusseldorf, Ehrenhof 4.

Electrical Engineers Exhibition.—The Rt. Hon. Sir David Eccles, K.C.V.O., M.P., President of the Board of Trade, will open Britain's largest-ever display of Electrical Equipment at The Electrical Engineers Exhibition to be held at Earls Court, on March 25, 1958.

Company News

Tootal Ltd. have purchased for cash the capital of Mendip (Chemical Engineering), of Ashford, Middlesex. This company, formed in 1954, has done pioneer work in the development of engineering materials based on the use of reinforced resins. The company will work in conjunction with Thermo-Plastics Ltd., recently acquired by the Tootal group.

Imperial Chemical Industries Ltd. has decided to bring all aspects of its polythene work under unified control. This means that, on and from January 1, 1958, all responsibility for production research and development, together with the assets and staff employed in the production of Alkathene, I.C.I.'s brand of polythene, will be transferred from I.C.I.'s Alkali Division, in whose laboratories polythene was discovered, to I.C.I.'s Plastics Division.

I.C.I. Create New Manufacturing Division.—The continuing growth in size and complexity of I.C.I.'s Billingham Division, both in the organic and inorganic chemical fields, has led the Board of I.C.I. to decide upon a separation of the Division's interests in organic chemicals, based primarily on petroleum, and the creation of a new Heavy Organic Chemicals Division. The decision will take effect on and from January 1, 1958. The chairman of the new Division will be **Dr. S. W. Saunders,** at present a Managing Director of the Billingham Division.

Monsanto Chemicals Ltd. announce that TRED 50 and TRED 85, styrene/butadiene resins are now available in commercial quantities from a modern plant at the company's factory at Newport, Monmouthshire. Previously these resins have been made on pilot plant scale.

Manchester Oil Refinery (Holdings) Limited announces the appointment of Mr. H. E. Harvey, M.P., a Director of Manchester Oil Refinery (Sales) Limited, as Manager of the latter Company. Manchester Oil Refinery (Sales) Limited, which is responsible for sales in the home market, will shortly move from Manchester to London.

Shaw Moisture Meters have moved into their new factory and laboratories at Rawson Road, Bradford. The Head Office address is unchanged—this is 31 Market St., Bradford.

Reliance-Clifton Cables and Industrial Products Ltd.—The Northern Ireland Development Council announces that one of the new "advance" factories at present under construction on the Carnmoney Estate near Belfast is to be occupied by a new subsidiary company of Reliance-Clifton Cables and Industrial Products, Ltd. of Leyton, London. The new company will be known as "Belfast Cables, Ltd." and will be initially equipped to manufacture plastic covered cables for Great Britain and overseas. The company plans later to extend its range of products.

Sidney Limburg, 38 Talbot Crescent, London, N.W.4, has been appointed sole agent in the U.K. for Messrs. Chr. Egelborg, Polyethylene Packaging Manufacturers, Copenhagen, Denmark.

Messrs. Egelborg manufacture lay flat tubing, bags for all commodities and supply all bags used by the slaughterhouses in Scandinavia for packaging all kinds of meat offals including casings.

Tube Investments Ltd.—The directors of Tube Investments Limited recommended at the Annual General Meeting on December 9, 1957, a final dividend on the ordinary stock of 7½% actual which with the interim dividend paid of 7½%, makes a rate for the year ended July 31, 1957, of 15%.

Messrs. E. I. Du Pont de Nemours & Co. Inc., and **Durham Raw Materials Ltd.,** jointly announce modifications in the arrangements under which Durham Raw Materials Ltd. have been the sole distributors of neoprene in the United Kingdom.

The Du Pont Company (United Kingdom), Ltd., with offices at 5 Charles II Street, London, S.W.1, has been formed to manufacture and sell neoprene in the United Kingdom and European markets. This company is a wholly owned subsidiary of Messrs. E. I. Du Pont de Nemours & Co. Inc. With effect from January 1, 1958, sales for neoprene will be made in the name of Du Pont Company (United Kingdom) Ltd., and Durham Raw Materials Ltd. will act as sales agents.

With effect from January 1, 1959, Durham Raw Materials Ltd. will surrender the agency and Du Pont Company (United Kingdom) Ltd. will assume full control of all neoprene sales.

Durham Raw Materials Ltd. wish to state that this changeover has been made on terms which are acceptable to both parties.

The change made by Messrs. E. I. Du Pont de Nemours & Co. Inc. is solely the result of a decision to manufacture neoprene in the United Kingdom and in accordance with their normal policy to handle their own sales from this plant.

Williams (Hounslow) Ltd. announce that Mr. M. C. Goodman at present their Representative in the East and Central Midlands will shortly move to Bristol to take over a similar appointment in the West Country.

Messrs. Alfred Green (Chemicals) Ltd. of Nunn Mills Road, Bedford Road, Northampton, Telephone No. Northampton 657, have been appointed agent for the area vacated with effect from January, 1958. They will also operate new store arrangements which have been designed to effect speedier deliveries to customers.

The Pena Copper Mines announce that at an Extraordinary General Meeting held on Monday, December 9, 1957, immediately after the Annual General Meeting, Resolutions were passed to change the name of the Company to Pena Industries Limited, and to reconstruct the capital of the Company.

L. A. Mitchell Ltd. chemical engineers of Manchester have opened an office in London at Portland House, 73 Basinghall Street, London, E.C.2 (Telephone numbers Metropolitan 8321/2).

Howards of Ilford Ltd. announce that they are now manufacturing, under licence from the Sugar Research Foundation, a range of the Sucrose or Sugar Esters.

Sucrose Esters are non-ionic surface-active agents which have important applications as non-toxic emulsifiers.

Stearate Plant Under Construction in Canada.—Construction of a new plant for the production of metallic stearates has been announced by William Wishnick, president of **Witco Chemical Company, Canada, Limited.**

The new plant, located southwest of Toronto, is expected to be completed early in 1958, and marks the first step in Witco Canada's plans for manufacturing facilities.

North British Rubber Co. Ltd.—A gigantic programme of research and development involving expenditure of £45 million over the next five years was announced by Mr. H. E. Humphreys Jr., President of United States Rubber Company, at the opening of the company's new research centre at Wayne, New Jersey. Mr. Humphreys, is also Chairman of The North British Rubber Co. of Edinburgh and Dumfries, now affiliated to the American company, emphasizes that this development programme will have far-reaching benefits to the British factories.

I.C.I. and Yorkshire Copper Works.—The Boards of the Yorkshire Copper Works Ltd. and Imperial Chemical Industries Ltd. have reached the conclusion that it would be wise to combine their activities in the copper and copper alloy tube and plate industry in a joint enterprise on the basis of equal participation. They are therefore exploring methods of achieving such a combination.

New BTR Aero Division.—The formation of a Group Aero Division is announced by BTR Industries Ltd., its operations embracing all the existing—and expanding—interests and activities of the BTR Group in relation to the aircraft industry. Marketing unit of the new Division will be Palmer Aero Products Ltd., a long-time member of the BTR Group under its former name of The Palmer Tyre Ltd. **Mr. C. G. Erlam,** who joins the Company after much experience in the aero industry, has been appointed manager of the new Division.

Union Carbide New Polyethylene Plant.—Production facilities for Union Carbide polyethylene resins will be markedly increased with the completion of a newly-authorized plant at Whiting, Indiana, U.S.A.

This new high pressure polyethylene plant, with a rated annual capacity of 72,000,000 lb., will raise Union Carbide's total rated annual production capacity to more than 375,000,000 lb. The new plant raises the total of Union Carbide plants involved in the production and compounding of Union Carbide polyethylene resins to nine. The new plant will be completed in the first half of 1959.

I.C.I. Severnside Project.—The Minister of Housing and Local Government has given his approval to the planning permission granted by the Gloucester County Council at the end of October to Imperial Chemical Industries Ltd. for them to develop a 1,000-acre site on Severnside in the Thornbury Rural District.

This project is for the manufacture of organic and inorganic chemicals.

Dr. H. G. Reid, the project's first General Manager, has been appointed President of Imperial Chemical Industries (New York) Ltd., with effect from January 1, 1958. His place as General Manager is being taken by **Dr. H. S. Hirst,** of the company's Billingham Division in

Members of the Chinese Economic and Technical Mission at Leicester Lovell & Co., Ltd., watch the production of a plastic tool for a German car manufacturing company.

Mr. C. H. Glassey presents the Beetle trophy to this year's winner, Mr. Charles Low. The P.I.G.S. chairman, Mr. C. C. Last, is in the centre. The presentation was made at a cocktail party given by British Industrial Plastics Ltd., in November.

Mr. J. K. A. Parkin

Air Commodore Sir A. Vere Harvey

Mr. G. Veit

Mr. E. Marland

Co. Durham. **Mr. J. D. Cousin,** is now Secretary of the Severnside project.

O. & M. Kleemann Limited Offer for Erinoid Limited.—Singer & Friedlander Limited on behalf of O. & M. Kleemann Limited have made an offer for all the Preference and Ordinary Stock of Erinoid Limited. The terms of the Offer, were as follows:—For every four £1 4½% Preference Stock Units of Erinoid Limited, holders will be offered £1 in cash and three 6% Preference Shares of £1 each in O. & M. Kleemann Limited.

For every four 5/- Ordinary Stock Units of Erinoid Limited, holders will be offered 16/- nominal of 7% First Debenture Stock 1978/82 and five Ordinary Shares of 1/- each in O. & M. Kleemann Limited.

R. H. Windsor Ltd. have announced their intention of manufacturing in Australia. The head offices will be in Melbourne, and they will operate under the title of R. H. Windsor (Australia) Pty. Ltd.

Personal

Mr. J. H. Warbrick.—It is with deep regret that we hear of the sudden death of Mr. J. H. Warbrick. Mr. Warbrick was the managing director of Warbrick (Engineering Specialties) Ltd.

Mr. R. J. Hetherington, aged 61, died on November 19 after a short illness. He joined The Micanite & Insulators Co., Ltd., 30 years ago where he was Works Accountant.

Dr. C. M. Blair has been appointed Vice-President-Planning of the Bakelite Company, division of Union Carbide Corporation, and **Mr. R. D. Glenn** has been appointed Vice-President—Development. **Mr. L. K. Merrill** has been appointed Vice-President—Technical.

Mr. D. B. Benedict has been elected a vice-president of Union Carbide Corporation. Mr. Benedict has been president of Union Carbide Chemicals Company, division of the Corporation. In his new position he will be responsible for the Corporation's chemicals and plastics activities.

The appointment of **E. E. Fogle** as president of Union Carbide Chemicals Company and of H. D. Kinsey as president of the newly formed Union Carbide Olefins Company, also a division of the Corporation has also been announced. The Olefins Company will handle the production and sale of ethylene, propylene, butadiene, and other hydrocarbon products.

Mr. E. Marland recently resigned from his position of Sales Manager with Robert McArd & Co., Limited, to take up a similar appointment with Samuel Bros. (Plastics) Limited, Talbot Mills, Ellesmere Street, Hulme, Manchester 15.

Mr. R. K. Reynolds.—Camp Bird Industries announce that Mr. R. K. Reynolds has been appointed Managing Director of Tenaplas Limited. **Mr. F. E. Oldham** has relinquished his position as Chief Executive to Tenaplas Limited, in order to devote his full time as Chief Executive to Hartley Installations Limited.

Mr. A. S. Baird and **Mr. C. C. Hawkins** have been appointed Directors of P. B. Cow & Company Ltd.

Mr. B. J. F. Dewson has been appointed Sales Manager of J. M. Collett & Co. Ltd., Gloucester.

Air Commodore Sir Arthur Vere Harvey, C.B.E., M.P., has accepted the Chairmanship of the Board of Directors of Aero Research Limited, Duxford, Cambridge, and Ciba Limited, Horsham. In this appointment he succeeds Sir Raymond Needham, Q.C., who has been Chairman since 1947 and remains a director of both companies.

Mr. G. F. Bassett, managing director of Ashdowns Limited, has been appointed to the Board of Reed Millican and Company Limited, Newcastle-on-Tyne. He will become managing director of this company early in January, 1958.

Mr. J. K. A. Parkin has been appointed Works Director of Lacrinoid Products Ltd.

Mr. F. S. Allen.—It is with deep regret that we hear of the death of Mr. Frank S. Allen, Works Director of E. K. Cole Ltd. and a Director of Ediswan-Ekco (Aust.) Pty. Ltd., Egan Electric Ltd., Ekco Electronics Ltd. and The National Ekco Radio and Engineering Co. Ltd. (India).

Mr. Allen, who was 56 years old, died peacefully in his sleep during Wednesday night November 20 while in London.

Mr. G. Veit has joined Messrs. Warbrick (Engineering Specialties) Limited, to act as Technical Sales Consultant for parts of the Midlands and the South of England on machinery and plant for the manufacture of wires and cables, and other extruded thermoplastic products.

Mr. J. A. de B. Hallows has joined the Southern Sales staff of Lacrinoid Products Ltd., Gidea Park, Essex, for compression and injection moulding. Mr. Hallows was previously with Resinoid & Mica Products Ltd.

Mr. J. H. Bridge has been appointed factory manager of Record Pressers Ltd. Mr. Bridges entered the plastics industry in 1942 and has held several administrative positions with Thos. De La Rue & Co. Ltd. and subsequently with National Plastics Ltd.

Mr. H. P. Potts has joined the Board of Directors of The Colchester Machinery Corporation Limited, of Toronto, Montreal and Vancouver, which is associated with the Colchester Lathe Company Limited of Colchester, Essex. Both are members of the 600 Group of Companies.

Meetings

December

13th.—Mobile Plant Discussion Group. "Torque Convertors," by A. L. Gattis. The Birmingham Branch of the Incorporated Plant Engineers, the Imperial Hotel, Temple Street, Birmingham. 7.30 p.m.

17th. — Chairman's Lecture on "The Plastics Institute, Press and Industry," by C. W. Welch. The London Section of the Plastics Institute, the Wellcome Building, 183–193 Euston Road, N.W.1. 6.30 p.m.

18th.—"Akulon—Type 6 Nylon," by R. van der Spek. The Scottish Section of the Plastics Institute, More's Hotel, Glasgow. 7.30 p.m.

January, 1958

2nd. — Young People's Lecture, "The Progress of Plastics," by Professor C. E. H. Bawn. The Plastics Institute, the William Beveridge Memorial Hall, Senate House, London University. 2.30 p.m.

8th.—"New Developments in Unsaturated Polyester Resins," by H. Williams. The South Wales and Monmouthshire Section of the Plastics Institute, Angel Hotel, Cardiff. 7 p.m.

Rubber and Plastics Conference

Programme

9.45–10.15. H. W. Melville, "Recent Advances in Polymerization Techniques."

A1: 10.15–11.15. H. A. Braendle, "Masterbatching Techniques."

A2: 11.45–12.45. R. Schooley, "Preplasticizing Methods."

2.15–2.45. Prof. G. Gee, "The Rubber-hike State."

A3: 2.45–3.40. Prof. A. Charlesby, "Radiation and Polymers."

A4: 4.00–5.00. T. Bain and W. H. T. Davison, "Radiation Processing."

B1: 10.45–11.45. Institut Francais du Caoutchouc. "Rubber/Resin Combinations."

B2: 11.45–12.45. F. Watson, "Mastication Polymerization."

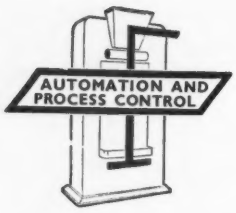
B3: 2.45–3.15. J. T. Watts, "Urethane Foam Process."

B4: 3.30–4.00. F. Chapman, "Expanded P.V.C."

B5: 4.00–4.30. A. Cooper, "Properties of Cellular Polymers."

4.30–5.00. Discussion.

The conference will be held at the Institute of Civil Engineers, Great George Street, Westminster, S.W.1, on Thursday, February 27, 1958.



Automation Equipment

Insulation Testing and Measurement.—Delsen Corporation has developed a new instrument for laboratory or factory use in the insulating materials field. The D-K Analyzer is a portable, non-destructive, direct reading instrument which measures the dissipation factor and dielectric constant of insulating materials.

The instrument can be used to investigate the effects of variables such as hardeners, fillers, and cure conditions in dielectric systems, to detect non-uniformities in the electrical properties of insulators caused by variable resin content or inadequate cure, and to inspect incoming material such as etched circuit board stock to insure conformance to standards. In addition, it lends itself to monitoring the output of continuously operating devices such as coating machines and to examining large finished systems such as radomes for uniform electrical properties. These are but a few of the possible applications of the D-K Analyzer.

The form of the probe associated with the instrument eliminates the need for specimen preparation. As a consequence, measurements are made very quickly and the results are indicated on two dials.

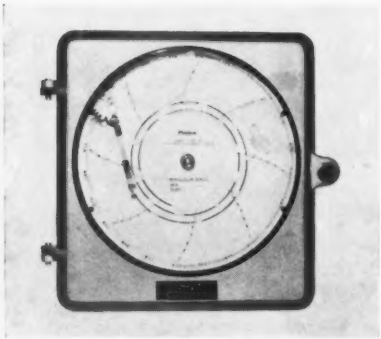
Delsen Corpn., 719 West Broadway, Glendale 4, California, U.S.A.

New Fielden Instrument uses Inkless Pen to give accurate record of Operations and Events.—The Fielden Organization have recently developed an instrument which will provide a permanent, visible and indelible record of operations and events. It may be used for registering the on/off times of machines or electrical circuits, for showing the rate at which items are being produced in a repetitive process and for recording the times when vehicles are in a particular area.

Two charts are available for the Operation Recorder, one being a 24-hour chart and the other seven-day. In both cases the chart is of specially prepared heat sensitive paper and an "inkless pen," consisting of a heated stylus, draws an indelible trace upon it. The pen is energized from a low voltage source and has a power consumption of less than one watt. Both pen and chart are driven by self-starting synchronous 50 c/s. clock motors.

The only external equipment necessary is a pair of contacts which will make when it is required to produce a trace on the Recorder and these contacts should be capable of handling the power required by the pen. When the contacts are closed and the stylus is heated, a black line approximately $\frac{7}{16}$ in. wide is produced. During the off periods a lower voltage is applied to the pen producing a faint, thin line on the chart. The difference between these lines is very clearly visible but the thin line does enable the trace to be followed even though no operations have been recorded.

Fielden Electronics Ltd., Wythenshawe, Manchester.



Fielden operations recorder.

Multi-Point Control Valves.—Where a number of main control valves are used in the construction of pneumatically or hydraulically operated machinery, the problem of providing inter-connecting piping for supply and exhaust connections becomes acute, particularly where space is limited, and the pipe size is relatively large.

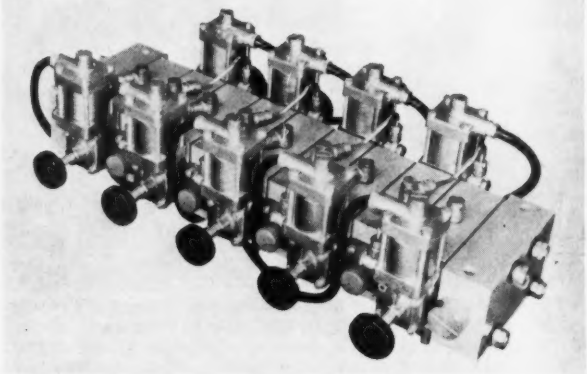
A neat and economical solution can be found by grouping the control valves at a central point in such a way that these interconnections are eliminated.

Baldwin Instrument Co., Ltd., have now introduced such a system, which is believed to be unique to the low pressure fluid power field. The valves, which may be fitted with manual, mechanical, electric solenoid or pilot operating mechanisms, are supplied as a multipoint "packaged unit." Any number of valves, up to a maximum of 12, can be embodied into a single unit. The supply and exhaust ports of all the valves are led into passages running the full length of the assembly, screwed connections being provided in special end pieces, which also provide facilities for mounting the assembly as a whole. Each end block contains one supply and one exhaust tapping, which are common to all valves, tappings in each individual valve body provide fluid take off points for solenoid pilot heads, where these are used. Each main control valve is therefore an entirely independent unit from the functional point of view.

The simplification which is effected by this type of unit may be gauged from the fact that fifteen connecting pipes are eliminated in the case of the 8-bank solenoid controlled pneumatic unit which is illustrated.

At the present time, these "packaged units" are available in the $\frac{1}{2}$-in. bore 4-way pattern only. It should also be noted that any desired mixture of operating mechanisms can be provided in a bank. If any of the points are required for 3-way working only, the unused cylinder connection is plugged.

Baldwin Intrument Co., Ltd., Brooklands Works, Dartford, Kent.



(Right) Multi-point control valves introduced by Baldwin Instrument Co., Ltd. control valves introduced by Baldwin Instrument Co., Ltd.

Foster electronic temperature controller.

Resistance Thermometer Controller.—This instrument has been developed as a low cost, accurate and durable fully electronic temperature controller for use in association with special Foster fast response thermometer elements, which provide a degree of control not normally obtained with standard elements.

Temperature ranges cover from — 50° C. up to +350° C. and the 15-in. long scale is overprinted with the equivalent Fahrenheit range. All resistances comprising the Wheatstone Bridge system are accurately calibrated and aged so that control point drift is entirely eliminated. The control operates on a differential of 0·1° C. but can be detuned to operate on wider differentials (up to 5° C.) if required by a simple adjustment of the sensitivity control.

Foster Instrument Co., Ltd., Letchworth, Herts.

TALKING SHOP . . .

London Section Lunch. One of the biggest luncheons of the London Section of the Plastics Institute was held at the Criterion Restaurant in London on November 7. In the chair was Mr. C. W. Welch, chairman of the London Section, and guests included Dr. J. C. Swallow, chairman of the Plastics Institute, Mr. Cyril Last, chairman of the British Plastics Federation, Dr. W. Bodger, chairman of the London Section of the Institution of the Rubber Industry, Mr. S. Thompson, Secretary of the Education Appeal Fund, Mr. J. Ratcliffe, secretary to council, Mr. L. Read, chairman of the South Wales and Monmouthshire Section, Mr. R. G. Farnsworth, chairman of the Midland Section, Mr. P. Morgan, editor of *British Plastics*, and Mr. M. D. Curwen, editor of *Plastics*.

The guest of honour, Councillor W. G. Fiske, gave the after-luncheon address. Chairman of the Housing Committee of the London County Council, Councillor Fiske spoke of the need for decentralizing much of industry in London, and outlined the help that the County Council was prepared to give in building factories in the new towns around London such as Harlow, Hatfield, Crawley and Hemel Hempstead. He also discussed the use of new materials in building construction, outlining the important part to be played by plastics in this field. His audience followed his comments with great attention as well as appreciation, for the L.C.C. is perhaps the biggest single customer for the building industry of Britain.

Mr. D. S. Mahon, vice-chairman of the London Section, moved the vote of thanks to Councillor Fiske.

* * *

Miss L. M. Barnett. I print with great pleasure a photograph of Miss Barnett, who as announced last month (page 450), has been appointed a director of Thermo-Plastics Ltd. Miss Barnett has had wide sales experience in the plastics industry, particularly in the aircraft and advertising fields.

* * *

Mr. M. D. Curwen. Last month the Council of the Royal Institute of Chemistry elected Mr. M. D. Curwen a Fellow of the Institute. This marks 40 years spent in the chemical field, first as chief chemist of the Anglo Mexican Petroleum Co. at the Minatitlán refinery, followed by consulting work, and editorship, first of the *Industrial Chemist*, and latterly *Plastics*. He has been editor of this paper since its foundation in 1937. Amongst his contributions to the chemical literature have been several notes on the properties and behaviour of metallic soaps. He has also lectured at international congresses on numerous occasion.

I can also now reveal that he possesses an alias, and under the guise of Dogsboddy has by turn amused and bludgeoned the readers of this paper for many years. To Dogsboddy, as well as to the more dignified figure behind, I offer congratulations on a very well merited honour.

* * *

Institute Lecture. Members of the London Section of the Plastics Institute were invited to a meeting of the I.R.I. in November to hear Mr. Wilson of the B.T.R. Group speak on polymers used in belting. The paper was excellently prepared and interesting in that whilst given to an audience predominantly concerned with rubber, it dealt at greatest length with p.v.c. Of all the materials at present used in belting, the conclusion seemed to be that p.v.c. was the most important.

Miss L. M. Barnett.

* * *

Speaker Panel Moulding. The photograph shown below is the rear view of the speaker panel for one of the range of Philips television sets. Employing a phenolic powder, the moulding has been carried out by Derwent Plastics Ltd., of Stamford Bridge, York. A special feature of the moulding lies in a sequence of five finishing operations carried out by Derwent Plastics automatically on a series of interconnecting jigs. The total finishing time for this moulding has been reduced, by the introduction of this automatic method, to two minutes.

Speaker panel for Philips television sets moulded by Derwent Plastics Ltd.

PLASTIKON.

(Left) Mr. L. M. Read, chairman, South Wales and District Section and Mr. T. S. Sprigg, Temple Press Ltd.

(Below left) L. to R. Mr. M. D. Curwen, Mr. C. W. Welch, Councillor W. G. Fiske, Mr. C. C. Last, Mr. H. Brookes.

(Below right) Mr. J. Ratcliffe, Mr. C. W. Oakhill, Mr. D. Mahon.

Machines for the Industry

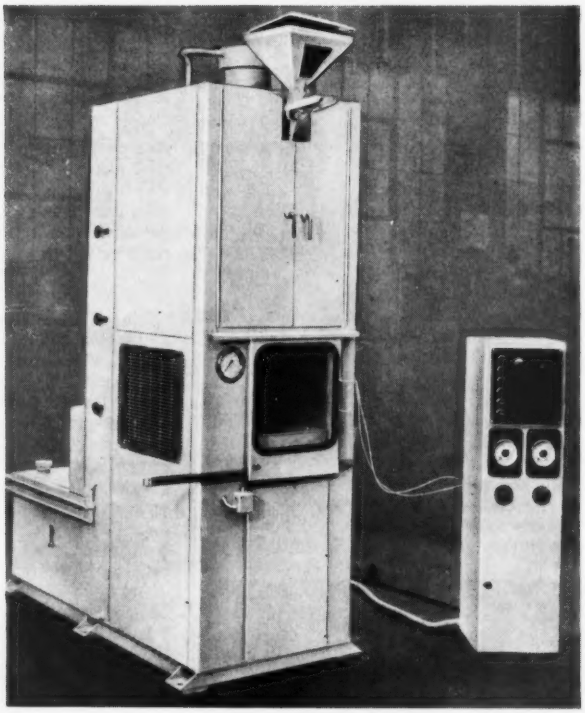
The Edgwick VHY 1½ oz. Machine

Details of the vertical injection moulding machine recently designed and manufactured by T. H. & J. Daniels are given.

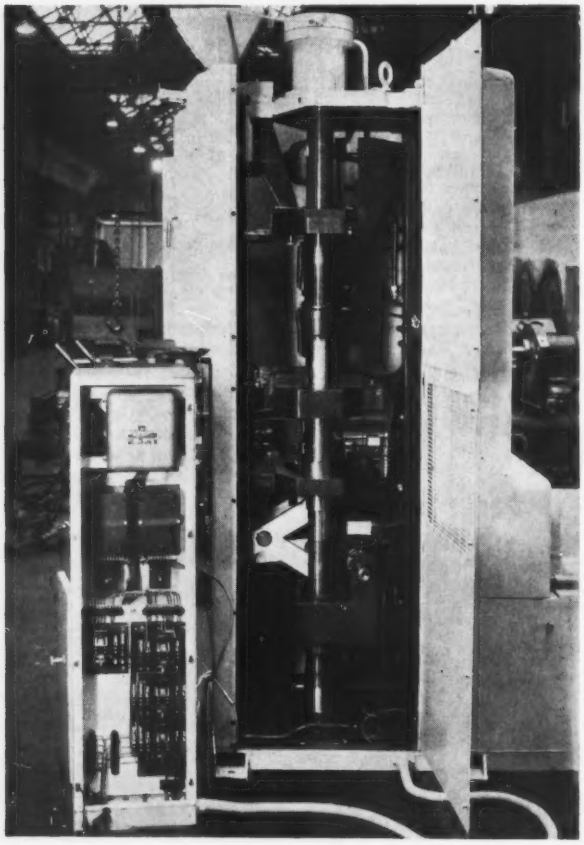
THE vertical injection moulding machine is not a common machine in moulding shops in this country. Indeed their manufacture has been discontinued for several years except for special orders where their characteristics have proved beneficial.

The principal disadvantage of this type of machine is its inability to eject the moulding from the machine and thus allow continuous automatic cycling. This has been overcome to some extent by using compressed air ejection from the mould faces, but again the risk of flash and sticking has not been eliminated entirely. To offset this, however, the big advantage of a vertical machine is when it is used for moulding around inserts. Quite obviously an insert is more prone to stay in position on a horizontal mould face than on a vertical face. Also the necessity for hand placing of inserts precludes a continuous automatic cycle and indeed faster cycle times can be maintained with the vertical machine than with a horizontal one.

From the foregoing remarks it can be seen that for such specialized work the vertical injection moulding machine is of some importance and it is therefore with pleasure that we are able to report on the Edgwick VHY 1½ oz. machine designed and manufactured by T. H. and J. Daniels Ltd., Lightpill Iron Works, Stroud, Gloucestershire.



A general view of the 1½ oz. machine and control cabinet.



A side view of the VHY showing the main frame and different platens. A good idea of the accessability of the working parts can be obtained from this view. On the left is the control cabinet showing the various relays.

General Design

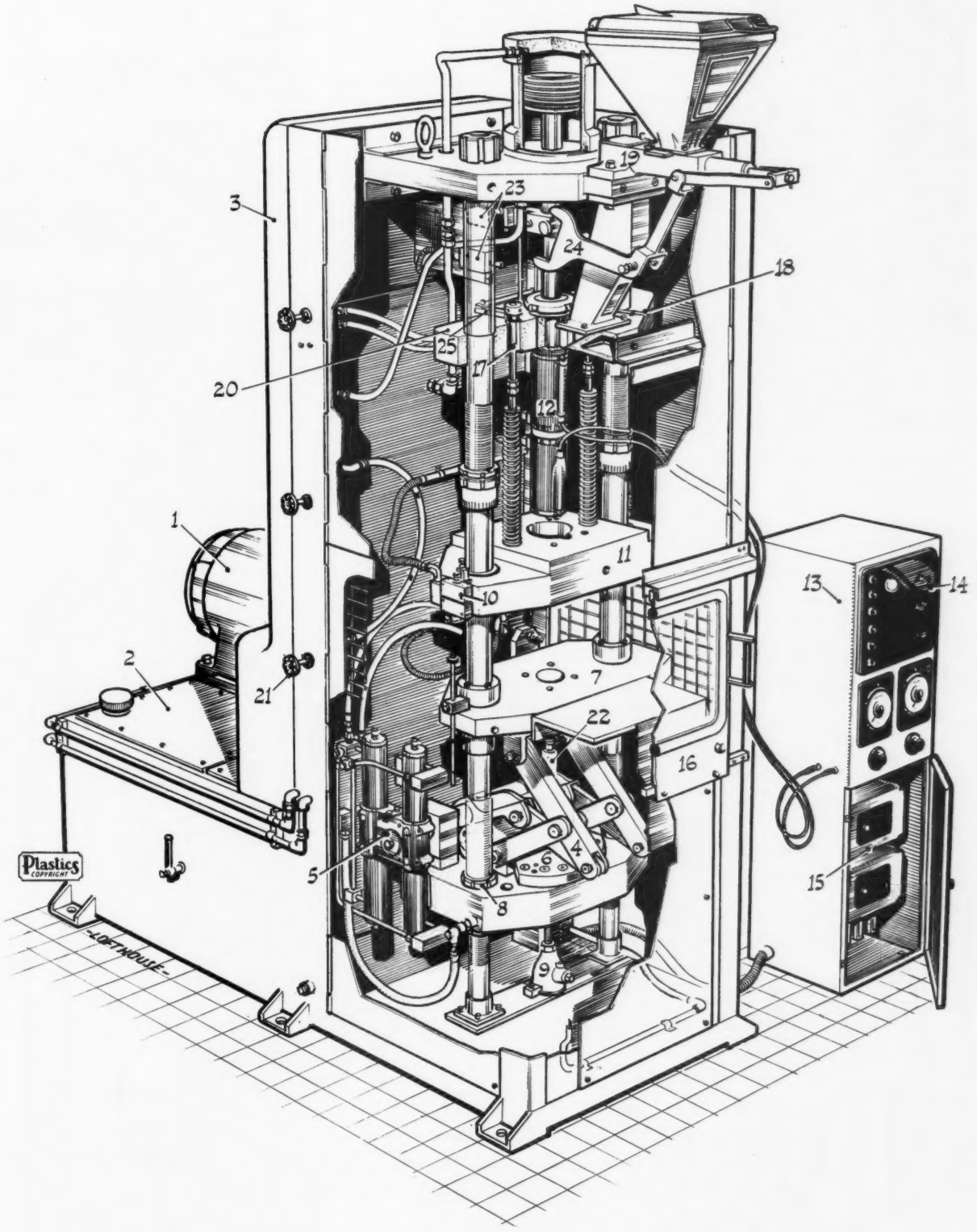
This machine is based generally upon the design of the 1½ oz. Edgwick horizontal injection moulding machine, and uses many of the parts from this machine in its construction.

It is a self-contained unit having provision for fully automatic operation and is capable of moulding the normal thermoplastics materials including nylon. The machine illustrated is fitted with a cylinder and nozzle for moulding nylon.

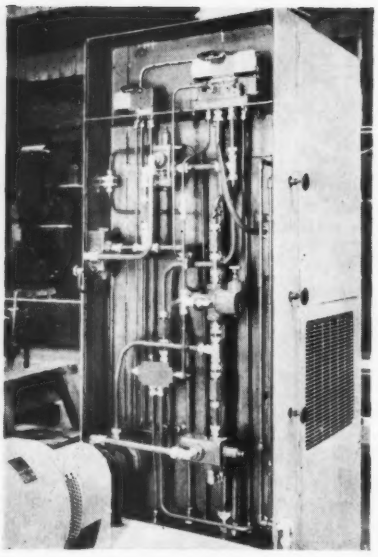
The hydraulic equipment is mounted at the back of the machine, the motor and pump (1) being mounted on top of the oil tank (2) and the hydraulic control valves and piping are all housed behind the removable rear cover (3).

Vickers Detroit pumping equipment manufactured by Stein Atkinson Vickers Hydraulics is used, operating at a maximum pressure of 1,000 p.s.i.

The moulds are closed by the toggle mechanism (4) which has a maximum stroke of 7¼ in. These toggles are normally operated by the hydraulic rack and pinion unit (5), but a hand setting lever is also provided for use during initial adjustment of the machine. After the toggles close, locking pressure is exerted by a short stroke hydraulic cylinder (6)



1.—Electric motor and pump; 2.—Hydraulic oil tank; 3.—Hydraulic circuit cover; 4.—Mould closing toggle; 5.—Rack and pinion unit; 6.—Mould locking piston; 7.—Mould platen; 8.—Die space adjusting nuts; 9.—Hydraulic jack; 10.—Limit switch assembly; 11.—Injection platen; 12.—Heating bands; 13.—Control cabinet; 14.—Main electrical panel; 15.—Timing and control panel; 16.—Sliding guard; 17.—Injection platen tie rods; 18.—Locking handle; 19.—Feed assembly; 20.—Water cooled crosshead; 21.—Water cooling control valves; 22.—Ejector bar; 23.—Injection stroke limit switches; 24.—Feed link assembly; 25.—Catch plate.



The hydraulic piping contained in the back of the machine. The cover has been removed to show this piping.

which will give a maximum die locking pressure of 35 tons.

To allow for varying depths of mould, the moving die plate (7), together with the toggle mechanism and hydraulic die locking cylinder, can be adjusted vertically by means of circular nuts (8). When these nuts have been slackened, a small hydraulic jack (9) is used to move the toggle unit assembly to its new position after which the circular nuts are again tightened.

In order to minimise the possibility of damage to the mould in the event of any unwanted material remaining between the mould faces, the limit switch assembly (10), which is operated by a pre-set stop on the moving die plate, is arranged to cut the electric supply to the pump motor if any pressure is applied to the injection platen (11) before the moving table has reached its normal, fully closed, position.

The heating cylinder (12) has two heater bands having a total capacity of 3.5 kW. These two bands are controlled independently by means of two Cambridge thermometer regulators fitted to the control cabinet (13) and additional control is obtained by means of Sunvic controllers which operate in series with the Cambridge thermometers.

Controls

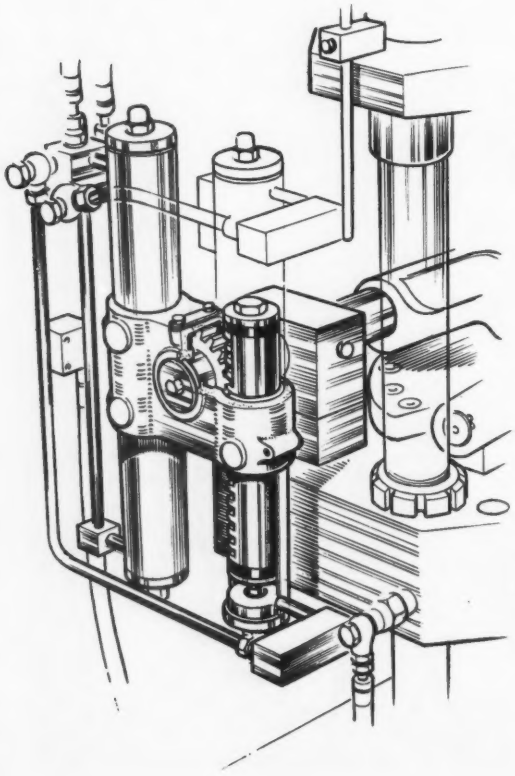
This cabinet carries an electrical panel (14) to which is fitted the mains " On/Off " switch, the injection cylinder heater switch and a switch giving a choice of " Hand," " One Cycle " or " Fully Automatic " operation. A row of pushbuttons on the left of this panel are used to control the movements of the machine when hand operation is selected and when in the " One Cycle " position each cycle is initiated by the operator pressing the button marked " Dies Closed." The machine then performs one cycle automatically, after which the operator removes the completed mouldings and initiates the next cycle by pressing the " Dies Closed " button again. The cycle is determined by the set of electronic timers (15) housed in the control cabinet and an additional timer is fitted which is used to initiate each cycle when the machine is operated fully automatically.

The sliding guard (16) is interlocked with the control mechanism so that the machine cannot operate until the guard is fully closed.

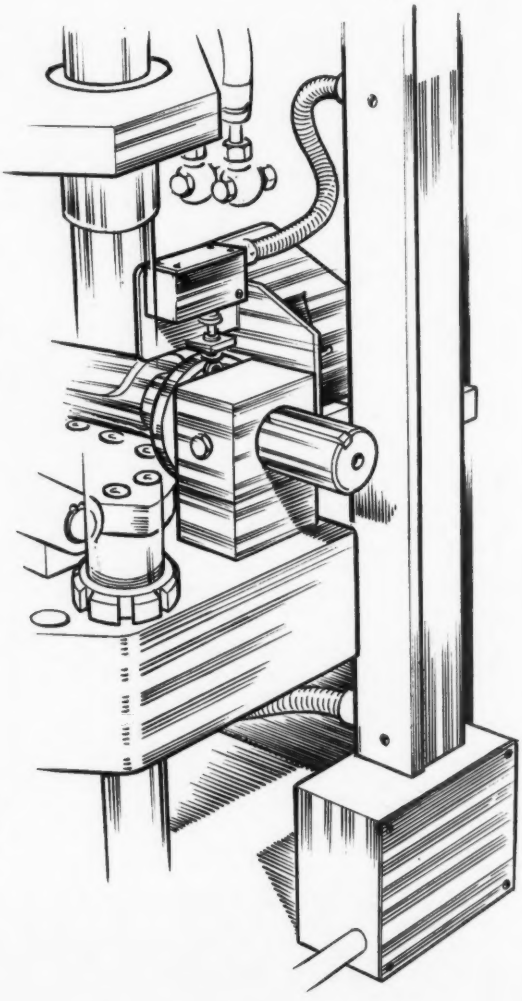
The injection platen (11) is retained in position by means of two tie rods (17) and a small amount of upward movement takes place against the compression of these springs each time the tables close. At the end of the cycle, when the mould has opened, these springs move the table down slightly to its original position, thus breaking the sprue and removing the mould slightly from the nozzle.

By operating the hand lever (18), the tie rods (17) are released so that the injection platen may be moved clear of the nozzle for cleaning, etc. The powder feed assembly (19) is of the self-contained type, the powder being metered by the plunger operated through a link mechanism (24) from the injection ram. The hopper has a capacity of approximately 20 lbs. of moulding powder.

Provision is made for cooling water, both for the upper and lower moulds, and also for the crosshead (20) carrying the injection cylinder. Flow of water can be controlled independently by the three valves (21).



(Left) The hydraulic rack and pinion unit which operates the mould close toggle mechanism.



(Right) On the opposite side of the machine is the spindle to which is fitted a handle when hand setting is required.

irgalite GREEN | YELLOW 6GS

ANOTHER NEW DEVELOPMENT BY

GEIGY

A new metal complex organic pigment for all types of plastics and rubbers. Irgalite Green Yellow 6GS can be used to produce a range of contemporary yellows and greens characterised by extreme fastness to light and heat. *Non-bleeding, non-chalking* and *rub fast.*

THE GEIGY COMPANY LTD., Rhodes, Middleton, MANCHESTER.

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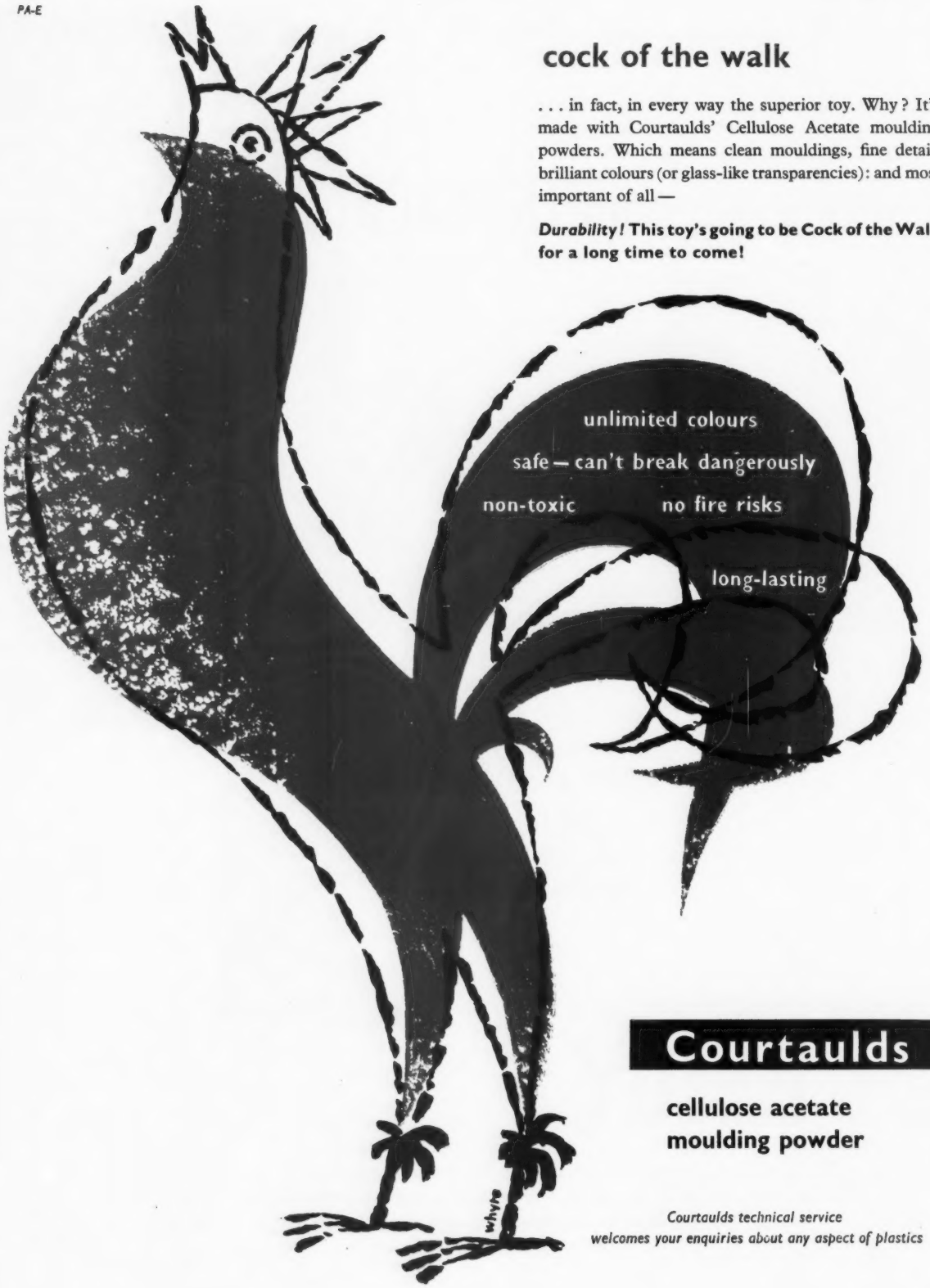
PA-E



cock of the walk

. . . in fact, in every way the superior toy. Why? It's made with Courtaulds' Cellulose Acetate moulding powders. Which means clean mouldings, fine detail, brilliant colours (or glass-like transparencies): and most important of all —

Durability! **This toy's going to be Cock of the Walk for a long time to come!**

Courtaulds

cellulose acetate moulding powder

Courtaulds technical service welcomes your enquiries about any aspect of plastics

Plastics Division Little Heath, Coventry. *Telephone* Coventry 88031.
16 St. Martin's-le-Grand, London EC1. *Telephone* MONarch 8811.

Overseas Distributors
Lustre Fibres Ltd., PO Box 65, Coventry, England.

New Automatic Wire Reeling Machine

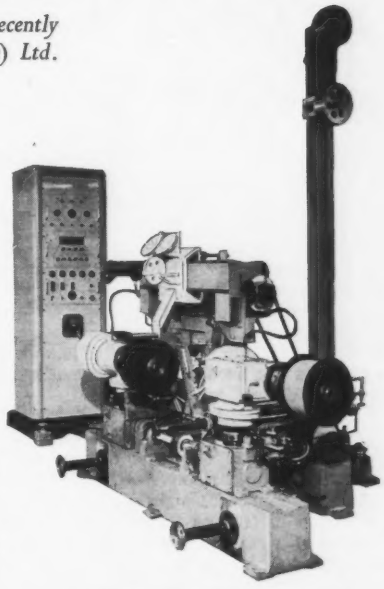
Details are given of the new reeling machine recently introduced by General Engineering Co. (Radcliffe) Ltd.

AN automatic continuous coiling and reeling machine that makes possible considerable economies as compared with hand reeling, and reduces risk of damage in handling, has been introduced by the General Engineering Co. (Radcliffe) Ltd., Bury Road, Radcliffe, Lancs. The TA 15 unit offers a continuous take-up of the type required for wire drawing, extruding, or continuous vulcanizing. The advantages include completely automatic drum loading and unloading if required. By the use of chuck adaptors coils can be wound on the standard machine.

Operation

Wire speeds of over 2,000 ft. a minute are attained on a 3¼-in. barrel diameter reel, with a 4-to-1 build up, the wound tension being as low as 2½ lb. The reels are carried on two pivoted winding shafts, each having an air-operated chuck to hold the reel. The drive is provided by a 5-h.p. electric motor, through suitable gearboxes, to a layshaft. From this point the transmission to the winding heads is through an electric clutch coupling and spiral bevel and helical spur gears. A reversing clutch-type traverse mechanism is employed, the traverse head working through a stepless variable speed V-belt drive and reduction gearbox, by way of two electric clutches, to a rack and pinion. The change from the loaded to the empty reel is operated by an air cylinder located at the traverse head. A "dancer" gravity-operated accumulator is linked to the machine, the moving carriage being coupled to the shaft of the variable speed gear, so controlling the speed of the reeler.

After threading up, the motor is started and, the wire being fed forward, the dancer carriage falls, so operating a switch that sets the reeler in action, the latter working at speeds matched with the capstan and winding at constant tension. Shortly before the changeover of winding from the loaded to empty reel the latter commences to accelerate. When the predetermined amount has been wound on to the first reel the normal traverse ceases and, in the space of a quarter-revolution, the quick traverse action moves the material over to the empty reel which takes up the wind, locking in automatically. A knife then moves forward, cutting the wire between the two reels. The full head is automatically braked and thereafter the shaft with the full reel pivots back through 180° to the unloading position where the reel is ejected. The return movement commences, a trip holding the shaft at the 90° position where an empty reel is loaded.



The reeling machine showing the control cabinet dancer carriage and one full reel in the unloading position.

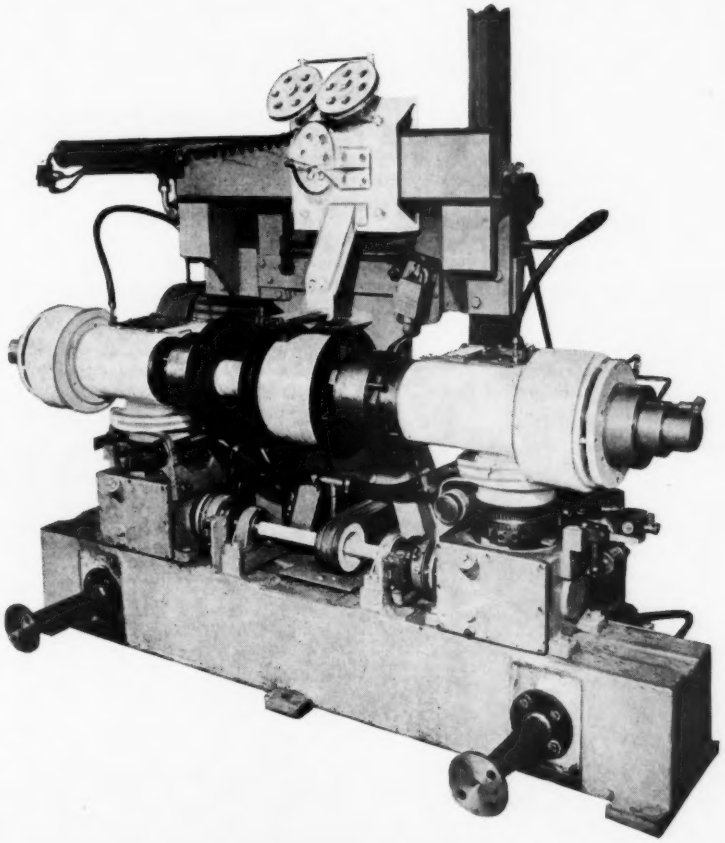
Supplementary Equipment

Supplementary equipment includes unloading and loading mechanisms. The latter is placed immediately in front of the machine with the reel carrier in front of the shaft when the latter is in the 90° position. Operated pneumatically, the machine is interlocked with the reeler. As the head reaches 90° the reel carrier presses the empty reel into the jaws of the chuck, the jaws automatically clamping on. When the reel carrier returns a further empty reel is placed in position ready for the next operation. Meanwhile the shaft returns to the working position.

Unloading Mechanism

For unloading there are two sheet steel ramps, one beneath the discharge position of each head. As the reel is ejected by the chuck the reel holder pivots to a right angle, turning the reel on edge so that it slides on to the unloading ramp. In the case of insulated wire, good and faulty reels are directed automatically into separate channels.

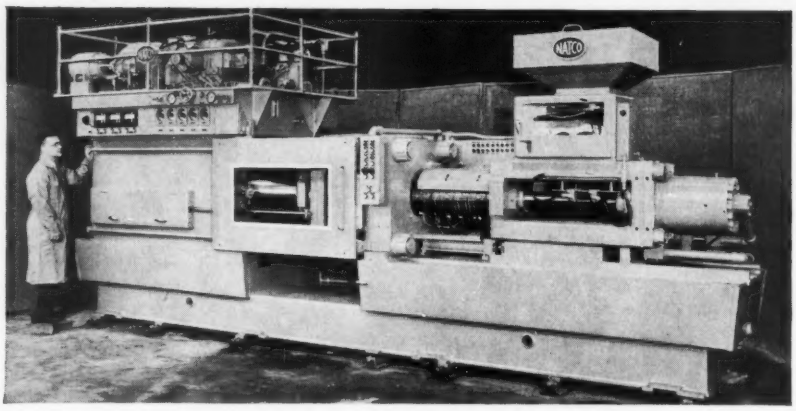
Operation of the machine is controlled by a Decatron counter that is excited by a pulse-type generator, working from a three-wheel measuring unit. A cabinet houses the controls for manual and automatic operation. The latter are fully electrically and mechanically interlocked.



A closer view of the machine with both reels in the winding position. The air cylinder which operates the changeover can be seen at the top left of the picture. Guards have been removed from the machine to show the operating parts.

American Report

Natco Injection Moulding Machines



IT was recently announced by the National Automatic Tool Company Inc., of Richmond, Indiana, U.S.A., that they had introduced the first of a range of new injection moulding machines. Emphasis, in the design of these machines, has been put on three features. The first of these is fast cycling, the second automatic operation, the third an hydraulic circuit that is both flexible and shockless in operation. There are, of course, other features of the design which will appeal to moulders but these will be apparent from the ensuing description of the machines.

All clamping, injecting and locking movements are operated by an hydraulic circuit. Mould closing speeds of over 600 ins. per minute are attained by using a booster ram with the locking force applied by hydraulic pressure on the full ram area (in less than 1 second) after closing. The main area of the ram is filled during the fast closing from the overhead oil reservoir. Just prior to closing an adjustable slow-down contact is operated thus preventing shock to the mould. These machines have also got a fast mould opening speed after an initial slow breakaway. This is fully adjustable to allow for ejection by the ejector bar mechanism.

To accommodate deep moulds an extensive daylight has been incorporated in the design giving, on the 400 (20 oz.), a maximum figure of 42½ in. and on the 800 (60 oz.) 70 in. These figures are with the ejector box removed and ejection operating from the mould by extending the two side knock-out rods, which are adjustable and normally operate against a bumber bar, through the platen.

The injection units on the Natco machines are fully retractable providing access to the heating chamber and nozzle. Retracting and advancing the unit is controlled manually by an independent hydraulic circuit which allows the unit to be moved at any time regardless of the position of the injection or mould clamp ram.

Hydraulic pressure seals the injection nozzle to the mould sprue bushing. At the option of the operator a positive sprue-break can be operated by the retraction of the nozzle tip at the instant the injection ram returns and it will not advance again until the mould clamp pressure has developed on the next cycle. The length of nozzle retraction is predetermined by an adjustable limit switch.

The heating chamber is an all-welded construction mounted to the injection platen by a single nut and designed to maintain injection pressure throughout the chamber. Internally the chamber is chrome plated to reduce frictional drag. The plastic is uniformly heated and two full shots of melted material can be contained in the blending section of the chamber.

Heating of the chamber is by band heaters divided into three zones with a separate heater for the nozzle.

Two sizes of injection plunger can be used, the normal 20,000 p.s.i. plunger and the 30,000 p.s.i. plunger for high pressure moulding at reduced shot capacity. The injection plungers and feed bushings have nitrided surfaces and the plungers are water cooled.

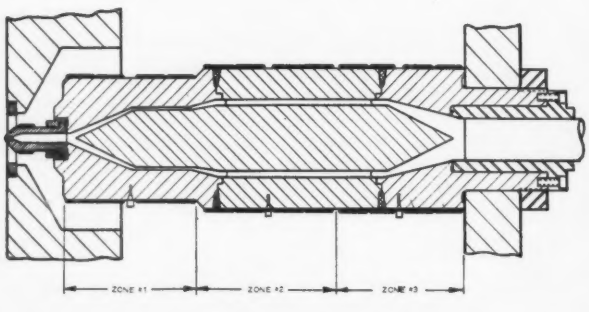
Besides high speed mould clamping, mentioned previously, the Natco injection moulding machines have fast plunger speeds. In order to control the filling of the mould cavity, however, it has been found desirable to reduce the plunger speed at the end of the stroke. To satisfy this premise two controlled speeds for the plunger are available. Each of these speeds is variable, high speed from maximum to 20% of maximum, slow speed from 20% of maximum to zero. In addition to the two plunger speeds there are two adjustable injection forward pressure ranges which are independent of the speed controls. Both ranges are adjustable from maximum to 25% of maximum.

Moulding powder is fed into the forward section of the water cooled feed bushing from a large capacity hopper via a vibratory type material feeder. This is fitted with an electric timer control and a compensating control. Starved or weigh feeding can be employed if desired. At the end of a run the removal of surplus material from the hopper to a storage container is effected by turning the vibrator trough through 90° and thus feeding over the side.

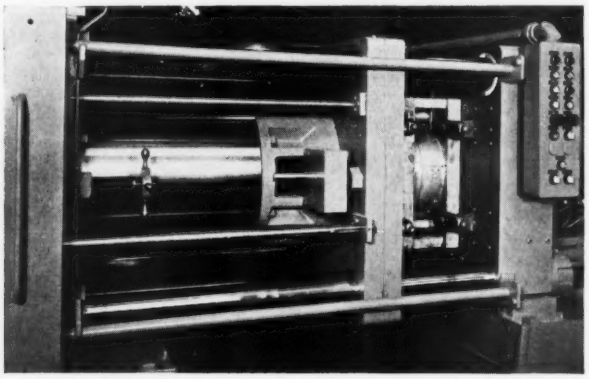
For increased shot capacity a double feed stroke is standard equipment enabling on certain moulding applications to secure up to 30% additional capacity over the single feed rating.

Hydraulic Circuit

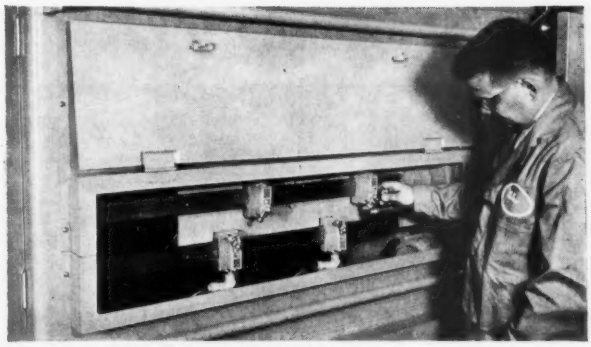
One of the principal features of this range of injection machines is the closed circuit hydraulic system. Instead of using conventional four-way operation valves to reverse clamp and injection rams these actions are accomplished by reversing the flow of the large hydraulic pump. Since this large pump serves both clamp and injection rams a flow diverter known as the master control serves to direct the hydraulic



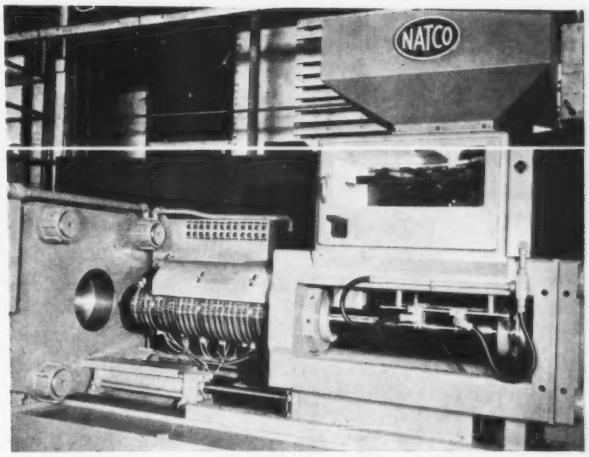
A drawing of the heating chamber and nozzle showing the size of the torpedo and method of fixing to the injection platen.



The mould close ram showing the ejector box in position and the side knock-out rods which can be extended through the platen.



(Above) The mould opening and closing relays.



(Right) The injection unit in the retracted position showing the band heater indicator lights and vibratory feeding unit.

pressure. This master controller operates only when the main pump is in the neutral position, between the forward and reverse positions, thus movement takes place under no pressure condition, eliminating any possibility of hydraulic shock.

Both the large reversing pump and the master control are shifted by an independent low pressure pilot control circuit.

A small constant displacement axial piston pump with separate motor drive, generates hydraulic pressure to maintain the desired mould clamping force while the large pump is serving the injection ram. To secure dual injection speeds and other slow speeds in the cycle the large reversing pump has variable displacement controls shifting the pump to partial stroke and thus avoiding the use of control or metering valves.

Both pumps are standard stock models designed and built by the Oilgear Company of Milwaukee, Wisconsin, and neither pump is operated at pressures exceeding 2,100 p.s.i.

Controls

Operating controls are situated conveniently on the fixed injection platen and all switches for both manual and semi-automatic control plus slow speed mould setting, injection unit retraction and material feed control are on this panel.

Temperature controllers, timers, pressure and speed controls are situated on a centralized panel.

The barrel temperatures are controlled by Taco-West proportioning type of pyrometers. These are self-contained controllers of the plug-in type. The nozzle temperature control is by a Variac regulator.

As an additional precaution each complete heating band is wired to a signal light station which indicates if each band half is functioning.

Five Microflex reset timers also of a plug-in type regulate the clamp close, injection first shot, injection high pressure, injection second shot, and material feed periods.

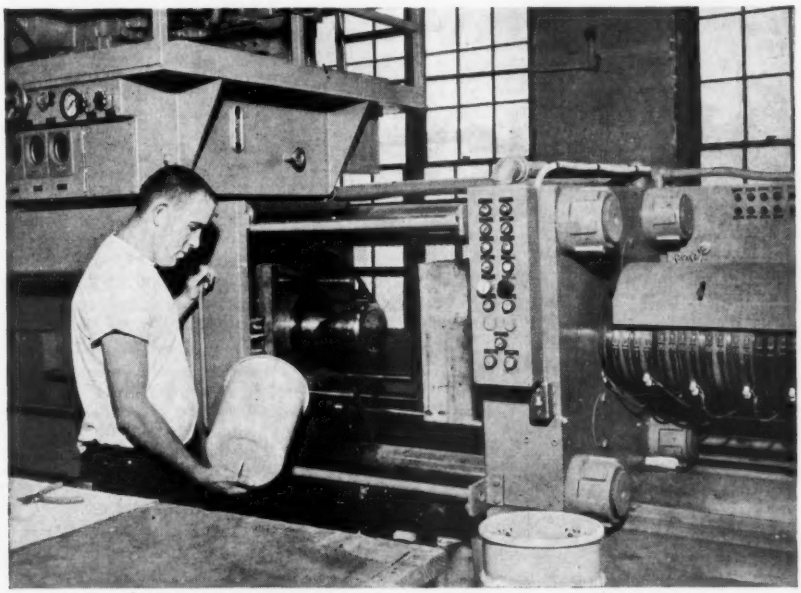
Other features of the Natco machines are, sub-plate mounted valves, pressure gauge check points, overhead oil tank, continuous oil filtration, a multiple pass heat exchanger for the hydraulic oil, automatic lubrication, and built-in water cooling lines giving controlled flow.

Examples of production rates are a 21½ oz. radio cabinet moulded in Dow 700 heat resistant polystyrene at the rate of 70 per hour; a 27 oz. polystyrene refrigerator drawer on a 45 second cycle; a 16 oz. polythene basket on a 30 second cycle; 12 oz. acrylic bus lenses on a 1 minute cycle; and a 17½ oz. cellulose acetate butyrate shot of telephone bases in which two brass inserts are prepositioned in the mould during each cycle of less than 1 minute.

The cycles described above were carried out on the Model 400 machine the specification of which is given.

Specifications—Natco Model 400

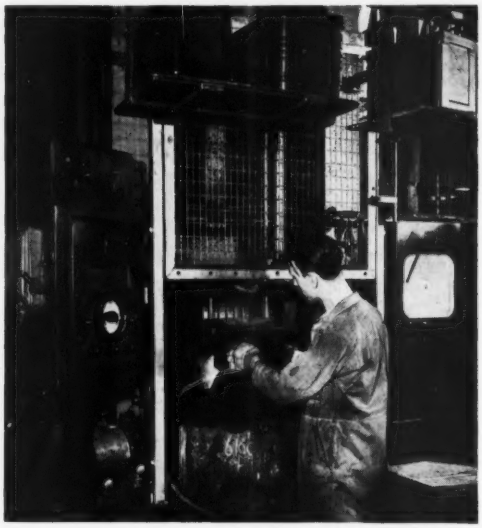
Material Injected (single plunger feed shot) at 20,000 p.s.i.		
Polystyrene (General Purpose)	..	28 oz.
Polystyrene (Shock Resistant)	..	28 oz.
Polyethylene (High Pressure)	..	16 oz.
Polyethylene (Low Pressure)	..	20 oz.
Cellulose Acetate	.. .. ..	29 oz.
Cellulose Acetate Butyrate	..	26 oz.
Methyl Methacrylate	.. ..	29 oz.
Plasticizing Capacity (Gen. Pur. Polystyrene), pounds per hour	..	165
Injection Pressure (at plunger to material interface) p.s.i.—		
	20,000	30,000
Injection Plunger Diameter	3½ in.	2⅞ in.
Injection Plunger Stroke	.. 15 in.	15 in.
Rate of Injection (cubic inches per second)	.. 19	13
Injection Plunger Speeds (inches per minute)—		
Inject (at maximum pressure)	..	119
Return	.. ..	295
Time of Injection (using maximum shot and pressure) seconds	..	3·5
Maximum Hydraulic Line Pressure	..	2,000
Mould Clamping Pressure—maximum		425 tons
Mould Opening Pressure	.. ..	21 tons
Mould Clamping Stroke	.. ..	26 in.
Daylight Opening (with ejector box installed)—maximum	.. ..	38 in.
Daylight Opening (with ejector box removed)—maximum	.. ..	50 in.
Mould Platens, overall	.. 38 in.	× 38 in.
Clearance Between Tie Rods	25 in.	× 25 in.
Ejector Stroke	.. .. ..	5¼ in.
Hydraulic Line Pressure—maximum		2,070
Motor (h.p. × r.p.m.) 3 ph. 60 cy. 220/440 volts	.. ..	40 × 1,200
Motor (h.p. × r.p.m.) 3 ph. 60 cy. 220/440 volts	.. ..	7½ × 1,800
Electric Heater KW (220 volts only)		24
Hydraulic Oil Required	..	.. 175 gals.



Moulding a 16 oz. polythene waste basket on a Natco 400 using a 30 sec. cycle. The extensive daylight is well illustrated on this moulding.

New Toughened Rubber Material

Details are given of a new toughened rubber material used for battery boxes. This material has been developed by G.E.C. working under patents of the Richardson Company of Illinois U.S.A.



Moulding a battery box in the new Im-Plast material.

THE term " hard rubber " has been applied in the past to rubber compounds, with or without fillers and accelerators, vulcanized or cured with approximately 40 parts of sulphur to 100 parts of rubber. Soft rubber compounds have sulphur in the ratio of up to three or four parts to 100 parts of rubber. Intermediate proportions of sulphur do not produce the results which might be expected in that the properties of the product do not change progressively as the sulphur proportion is adjusted and in general the compounds resulting from the use of sulphur in proportions between, say, 6% and 30% find no application. Thus there has been a gap in rubber technology in the range of hardness available in rubber compounds.

The only rubber-based materials in the intermediate hardness range were basically soft rubbers carrying a very high filler content and showing poor physical properties, especially abrasion resistance.

In recent years two methods have been developed to overcome this situation and to extend the range of rubber-based materials.

A.—Copolymers of styrene such as styrene/butadiene are now available which, when compounded with rubbers and taken to the soft cure stage, yield a product of increased hardness and modulus. The processing qualities are greatly improved and the product has a low specific gravity. Such compounds can be made to possess leathery characteristics. The improved processing is due to the fact that the copolymer resin is soft at processing temperatures and blends into the rubber phase completely, helping it to mix with the other components more readily.

B.—It has long been felt that great benefits would accrue from combining the properties of phenolic resins and rubber, but in the past difficulties in physically combining the two materials prevented progress. New resins and techniques have been developed which enable semi-hard rubber products to be produced incorporating phenolic type resins. Resins are now available which blend readily with natural and synthetic rubbers and which can be cured by means of hexa simultaneously with the cure of the rubber to produce products with higher hardness and tensile strength than soft rubber products having the same sulphur content. These phenolic resins also improve processing qualities, helping to keep the temperature under control during the mixing process and assisting in the dispersion of the ingredients of the mix.

Battery Containers

Battery containers have for many years been made in hard rubber of the conventional type, using blends of raw and reclaim rubber with fillers and a high sulphur ratio. They are also being produced in various compositions based on coal-tar pitch, bitumen, or asphalt as binder, with asbestos or cotton for reinforcement.

For special applications some use has been made of high impact styrene copolymers and polythene. The progress in rubber technology, as outlined, has led to further study of the requirements for battery containers and it is now possible to improve on the impact strength and heat resistance of the hard rubber containers while reducing their specific gravity and dimensions and still retaining adequate rigidity. Materials have been developed along these lines by the G.E.C. working under patents of the Richardson Company, and these materials have been given the name Im-Plast.

In developing these new Im-Plast materials consideration has been given to:

(1) Producing a material and a container with emphasis on maximum economy in weight and dimensions.

(2) Producing a material and container for replacement of existing types where certain external sizes must be preserved.

The development of these materials presented several problems:

(1) A suitable balance had to be achieved between the various methods of hardening the rubber compound, viz. vulcanization, reinforcement with styrene copolymers, and the incorporation of phenolic type resins and hardeners.

(2) The filler content had to be studied exhaustively.

(3) Improved curing systems are now available through the use of organic accelerators, especially in combination, and these must be so arranged that they do not interfere with the curing of phenolic resins if these are also present.

(4) The rubber content may be provided in the form of raw rubber, or as reclaim of various types, or both. Reclaim helps to reduce the cost and speed up the cure, but its use in excess leads to some degradation of properties. Here again, therefore, a carefully considered balance must be achieved.

The original basis of Im-Plast materials was provided by the Richardson Company of Melrose Park, Illinois, U.S.A., and work along the lines discussed above has led to the development of two materials, Im-Plast and Im-Plast 32.

Their principal properties are tabulated below:

	Im-Plast 32	Im-Plast
Acid Resistance		
1.250 S.G. acid at 60° C., 28 days	<20 mg. p.s.i.	<20 mg p.s.i.
Impact Strength		
B.S.S.903 ...	0.20–0.25 ft. lb.	>0.50 ft. lb.
2 lb. ball	15–25 in. lb.	>40 in. lb.
Hardness Shore D	66–68	70–75
Plastic Yield		
Ministry of Defence Specfn....	0.5–1 mm.	0.51–1 mm.
S.G.	1.27	1.23
Water Resistance		
7 days at 60° C....	<1%	<1%

These materials are produced under licence from the Richardson Company's patents but have been modified by the G.E.C. to suit the requirements of the British market.

It is of the utmost importance in the manufacture of materials of this type that careful controls are established over the raw materials, and over their processing, storing and moulding.

The moulding procedure is also set up with precision in order to achieve the optimum in speed of cure and properties of product.

Testing

Testing is carried out extensively on the mouldings in the belief that it is the final product which really counts rather than results obtained on separately-moulded test pieces prepared under laboratory conditions.

Impact strength is tested by means of a dropped ball test.

The hardness of the product is also an indication of consistency of quality and is continuously checked by means of a penetration needle test of the Durometer type.

Samples are cut from boxes at regular intervals for acid resistance tests.

Finally, every box made is subjected to a 40,000-volt test between cells and from inside to outside of the box to detect any flaws which may occur.

Graft Copolymers—Part 2

By S. H. PINNER*, Ph.D., F.R.I.C. and V. WYCHERLEY*, B.Sc.

The authors discuss here the synthesis of graft polymers using high energy radiation

THE chemical methods of synthesis of graft copolymers, as described in the first part of this paper, are of considerable technical interest but through economic factors are unlikely to lead to commercial exploitation except for special purpose materials. The economics of grafting to natural rubber are more favourable. Such methods as continued emulsion polymerization with the pre-formed latex and by rubber mastication in contact with the monomer do not constitute high cost techniques and have indeed been commercially exploited. The prospects for industrial utilization of graft materials are greatly improved by the availability of sources of high energy radiation. The application and control of such high energy radiations has been under intensive study during the past decade, largely under the stimulus of the need for the disposal of radioactive waste materials arising as a by-product of the nuclear power programmes. Success in these studies has led to some side-tracking of the original issue insofar as it is now thought that in the commercial utilization of high energy radiation, electric machines rather than radioactive isotopes or fission products will be preferred because of greater ease of control. The economic future of high energy radiation as an industrial tool has been recently reviewed (1).

The initial action of high energy radiation (whether neutrons, X-rays, gamma rays or accelerated electrons) on covalently bonded materials, is to displace electrons from bonded orbitals. The highly energetic primary products attain a lower energy level by decomposition in a variety of ways leading to such entities as excited molecules, positive radical ions, carbonium ions and free radicals. The presence of free radicals is readily detected by paramagnetic resonance absorption studies (2) and by interaction with radical traps (3). Some of the primary products, however, escape interaction with radical traps and this is the chief reason for postulating short-lived charged forms. Any positive radical ions formed are considered to dislink into a radical and a carbonium ion. The carbonium ion may acquire stability by loss of a proton or it may capture an electron to yield a free radical. A probable reaction scheme based on studies of the radiolysis of simple hydrocarbons has been given by Davison (4). At low temperatures, the carbonium ions may survive long enough to initiate cationic polymerization (5). At normal temperatures, however, the viability of the carbonium ion is suppressed and all subsequent reactions appear to be those typical of free radicals.

Polymers vary in their response to high energy radiation. With one group of materials, exemplified by polyethylene and silicones, recombination of the free radicals leads to crosslinking and, in due course, insolubility and infusibility. With another group of polymers, e.g. polyisobutylene and polymethyl methacrylate, steric factors restrict radical recombination and chain scission results. The effect of radiation on commercially important polymers has been classified by Wall (6) and Chapiro (7).

It was very early observed that when polymerizable olefins were exposed to high energy radiations, they were readily converted into polymers (8). The propagating entities at normal temperature were demonstrated unequivocably to be free radicals by Seitzer and Tobolsky (9). Much of the work on radiation induced polymerizations has issued from the laboratory of Magat and Chapiro at the Sorbonne and this field has recently been reviewed (10).

Since high energy radiation has been demonstrated to be capable both of creating free radicals in polymers and of initiating polymerization of olefins, it was reasonable to expect interesting new products to emerge from the radiation of mixtures of polymers with monomers. Chemical union of the polymer and monomer by such treatment was proved by an experiment in which polystyrene sealed in vacuo was irradiated with Cobalt-60 gamma rays and then exposed to the vapour of acrylonitrile which had been isotopically labelled with Carbon-14. The polystyrene was found to have acquired radioactivity due to the presence of grafted acrylonitrile side chains. Similar results were obtained with nylon in place of polystyrene (11).

It is only slightly less obvious that block copolymers may result from the irradiation of mixed polymers. Thus one might expect to obtain an insoluble crosslinked block copolymer from a mixture of two crosslinking polymers, and a high molecular weight branched block copolymer from a mixture of crosslinking and dislinking polymers.

In principle, therefore, the production of graft and block copolymers by means of high energy radiation is very facile. In practice, a number of complexities arise.

Routes to Graft Copolymers

Examination of the patent literature reveals three approaches to the formation of graft copolymers by irradiation.

(*a*) *Pre-irradiation Method*

The polymeric substrate is irradiated in an inert atmosphere to produce " frozen-in " free radicals and is then quickly immersed in pure monomer to initiate polymerization (12).

(*b*) *Peroxide Method* (13)

The polymeric substrate is irradiated in air or oxygen to produce peroxide bonds. These are reasonably stable and the polymer can be stored in the cold without loss of activity. If heated subsequently in the presence of monomer (as liquid or vapour) to about 150° in the absence of air, the peroxide groups decompose liberating free radicals which can then initiate polymerization.

(*c*) *Direct Method* (14)

The polymeric substrate is irradiated in admixture or in contact with the monomer so that polymerization *in situ* occurs.

The fourth method of irradiating mixtures of polymers either in the solid state or in solution, and in the presence or absence of monomers appears to be less well developed at the present time. Each of the three methods indicated above is appropriate to a particular situation. Evaluation of their relative merit requires a closer consideration of the processes operating.

Polymers, by and large, are mutually incompatible. Due to a segregative tendency, the presence of physically-mixed polymer-impurity yields a product with poor physical, optical and electrical properties. Certain known and prized exceptions to this rule exist but it is generally safer to assume that polymer syntheses should avoid physical admixture if useful products are to result. The major emphasis in the synthesis of graft copolymers is therefore to avoid homopolymer formation since its separation would add considerably to the cost of the process. It is also desirable to ensure complete polymerization of the monomer because unreacted monomer is also an undesirable impurity and not readily removed by drying or washing procedures. Synthetic methods are biased also in favour of low doses of radiation, where possible, in order to keep the costs down and to avoid damage to the polymeric substrate. Further considerations may involve chemical engineering and other factors such as bulk handling, maximum radiation-source utilization and ease of control. Special problems arise when the grafted products are desired to have geometric specificity, as when fibres are to be grafted on their surface only or in the production of sandwich materials.

To avoid homopolymer formation, the chief problem is to ensure true molecular contact between monomer and polymer. Even if this is initially established, it needs to be maintained during the radiation treatment while the monomer is undergoing conversion. This creates problems of solvation and diffusion. The most satisfactory conditions for the direct grafting procedure are attained when all the monomer required to be grafted is fully imbibed by the polymer. Diffusion control is then eliminated and the irradiation can be continuous. To combine large amounts of monomer with polymer in this way, it is necessary for the monomer to be a solvent or a plasticizer for the polymer. Here we encounter a paradox insofar as the most desirable objective of grafting might be to create a combination of a polymer with a monomer of dissimilar chemical nature. The need for solvation, however, requires the monomer to be of a similar chemical nature. This raises an obstacle to the synthesis of types of graft polymer that, in theory, would have the most attractive properties, e.g. a union of a hydrophobic with a hydrophilic material.

Apart from solvation and diffusion, consideration has to be given to the relative ease of free radical formation within the polymer and within the monomer. If the latter is inherently more sensitive to radiation, then initiation

*T.I. Research Laboratories.

within the monomer will tend to favour homopolymerization. Ballantine (15) has classified polymers and monomers in terms of sensitivity to radiation with this thought in mind. However, this feature is not of critical importance as will be seen from the discussion on the grafting of polyethylene. For example, the relative amount of homopolymer formation is influenced also by the relative concentrations of polymer and monomer. Even when the latter is very sensitive to radiation, if irradiated in the presence of a large excess of polymer, it will tend to graft exclusively to the polymer.

It is because of these limitations of the direct grafting method that attention has been given to the pre-irradiation and the peroxide methods. In principle, these methods will not give any homopolymer because the monomer itself is never exposed to radiation. The pre-irradiation method gives very low yields of grafted material because of the very low concentration of "frozen-in" radicals that can be achieved. There is also some uncertainty as to the role played by oxygen in this pre-irradiation technique which will probably find little commercial use.

Peroxidation provides a means of creating a relatively large number of initiating sites on the polymer. Subsequent heating to about 150° is required to liberate the free radicals and this in turn requires a thermally stable polymer.

Although pre-irradiation and peroxide techniques eliminate dependence on diffusion, there are situations where diffusion control can be exploited. During the grafting of styrene to polythene films, it was observed that increasing the thickness of the original film decreased the weight fraction of graft polymer but led to a constant degree of grafting per unit surface area. This indicates that the surface becomes rich in the new polymer but the interior remains unaffected. Applied to fibres, this allows a superficial layer of graft copolymer to be deposited without affecting in any way the internal structure of the fibre.

Direct Grafting of Polythene

More work appears to have been carried out on the grafting of polyethylene than any other polymer. The most suitable monomers to use are those which swell polythene appreciably at normal temperature (16). Such monomers are vinylidene chloride, styrene and methyl methacrylate in order of decreasing swelling power. These three monomers illustrate the variable results arising through the interplay of radiation intensity, diffusion and radiation sensitivity. In the case of vinylidene chloride, the degree of swelling and the diffusion rate is high. If a sample of polythene swollen in vinylidene chloride is exposed to high energy radiation at varying intensities, then the yield of deposited polymer per megarad is found to vary with intensity as illustrated in Fig. 1. The plateau reached with the gamma ray curve indicates exhaustion of the imbibed monomer. Still higher concentrations of deposited polymer can be attained with extremely low radiation intensities which allows diffusion of vinylidene chloride into the polythene to keep pace with its rate of conversion within the material. However, polymerization tends to occur at the same time within the monomer reservoir, which limits the value of this technique.

Similar results are obtained with styrene but here the radiation sensitivity of the styrene is reduced, which enables diffusion more readily to keep pace with conversion.

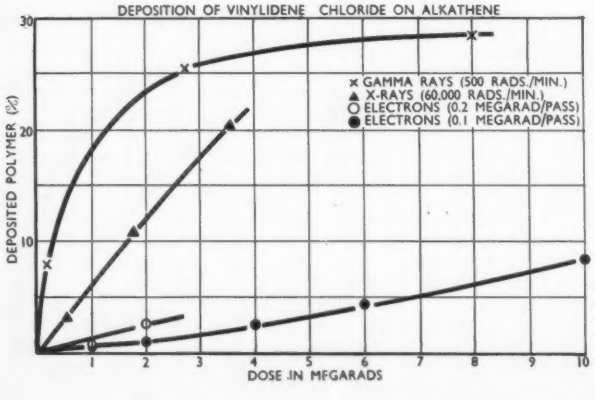
With methyl methacrylate, the monomer is extremely rapidly converted into polymer. Moreover, the initial degree of swelling is low (about 6% at room temperature in low density polythene) and the diffusion rate is very low. Consequently, the diffusion of the monomer is the dominant rate-controlling step and even if the radiation is carried out at 60°, it is difficult to obtain a product containing more than 15% of methyl methacrylate polymer regardless of the intensity of irradiation. In order to assess the physical properties of polythene containing larger amounts of grafted methyl methacrylate an "intermittent" swelling technique has been adopted. The swollen polythene sample is given sufficient radiation at low intensity to convert all the monomer present, and then reimmersed in fresh monomer. Further absorption of monomer occurs and the sample is again irradiated. By repeating the process, polythene containing up to 80% of deposited methyl methacrylate has been obtained (16). A comparison of the direct grafting of methyl methacrylate and the intermittent immersion technique is illustrated in Fig. 2.

Despite the attainment of high concentrations of deposited polymer in this way, extraction with chloroform reveals that a considerable proportion of the deposited material is not linked to the polythene substrate. This probably stems from two causes. Polymethyl methacrylate is degraded by irradiation so that individual molecules linked to the polythene matrix may be subsequently broken off by further irradiation. Secondly, it must be recognised that during swelling of the polythene in the monomer only the amorphous regions of the polythene are penetrated. The spherulites remain essentially unswollen and undergo crosslinking by the irradiation. Subsequent immersion of the initial graft allows more monomer to penetrate the amorphous regions which are already enriched by polymethyl methacrylate. In substance, the intermittent process involves grafting of methyl methacrylate to its own polymer. This feature will tend always to occur during the direct grafting of polythene but is, of course, magnified by the intermittent immersion technique. As a result, there is a definite limit to the amount of non-polar monomers that can be grafted to polythene using the direct radiation technique.

Similar experiments with acrylonitrile and polythene indicate that a maximum of 9% deposited polymer can be obtained by direct electron irradiation using the intermittent immersion technique and a dose of 4 megarads. Using polythene film in contact with liquid acrylonitrile and Cobalt 60 gamma irradiation, a 72% weight gain was observed with only 0.15 megarad. This testifies further to the effect of intensity on the yield of graft polymer per megarad. Oddly enough, in these cases, the deposited acrylonitrile polymer was not detachable by extraction with dimethyl formamide and the structure did not differ appreciably from that obtained by the peroxide technique. The three techniques are compared in Tables 1 (*a*), 1 (*b*), 1 (*c*).

Under conditions of direct radiation grafting where an adequate reserve of monomer exists, the relative sensitivity of methyl methacrylate and styrene, in terms of the relative radiation dose required to give the same amount of deposited polymer, exhibits the same ratio as is observed when homopolymerization rates are compared. This same ratio is also observed when comparing the radical initiation rates (G values) for these two monomers. This would suggest that the propagation rates of styrene and methyl methacrylate are of the same order of magnitude and that the increased sensitivity of methacrylate in grafting, as well as in polymerization, derives entirely from the increased ease of initiation of methyl methacrylate radicals, whether these are caused

(Right) Fig. 2
(Below) Fig. 1


DEPOSITION OF VINYLIDENE CHLORIDE ON ALKATHENE
DEPOSITED POLYMER (%)
DOSE IN MEGARADS
× GAMMA RAYS (500 RADS./MIN.)
▲ X-RAYS (60,000 RADS./MIN.)
○ ELECTRONS (0.2 MEGARAD/PASS)
● ELECTRONS (0.1 MEGARAD/PASS)

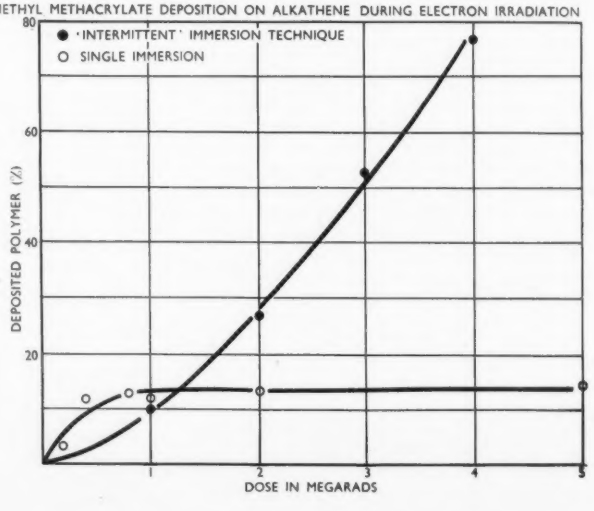

METHYL METHACRYLATE DEPOSITION ON ALKATHENE DURING ELECTRON IRRADIATION
● 'INTERMITTENT' IMMERSION TECHNIQUE
○ SINGLE IMMERSION
DEPOSITED POLYMER (%)
DOSE IN MEGARADS

TABLE 1

DEPOSITION OF ACRYLONITRILE ON POLYETHYLENE WITH VARIOUS RADIATIONS

(*a*) Electron irradiation with intermittent immersion. Alkathene Grade 2, 1.5 mm. thick

Dose in megarads	Dose rate megarad/pass	Weight gain %	Weight fraction deposited polymer %	Solubility in DMF* %	Weight fraction graft copolymer %
1	0.2	1.2	1.2	—	—
2	0.2	2.5	2.4	2.0	0.4
3	0.2	5.6	5.3	0.7	4.6
4	0.2	9.8	9.0	0.6	8.4

(*b*) Irradiation of film in absence of air with continuous immersion. Alkathene Grade 7F, 5/1,000 in. thick.

Dose in megarads	Dose rate rads/min.	Weight gain %	Weight fraction deposited polymer %	Solubility in DMF %	Weight fraction graft copolymer %
0	0	0	0	2.9	—
0.046	540	13.4	11.8	—	—
0.062	730	23.8	19.2	0.8	18.4
0.085	1,000	20.0	16.5	0.7	15.8
0.09	1,290	25.5	20.2	0	20.2
0.09	1,900	29.0	22.4	2.4	20.0
0.15	3,200	72.0	41.8	0.8	41.0

(*c*) Air-irradiated film subsequently heated in monomer. Alkathene Grade 7F, 5/1,000 in. thick previously irradiated in air with dose of 10 megarads.

Temp. ° C.	Time mins.	Weight gain %	Weight fraction deposited polymer %	Solubility in DMF %	Weight fraction graft copolymer %
150	30	64	39	0	39
160	30	118	56	0	56
160	60	180	64	0	64
160	120	135	57	—	—
160	180	403	80	0	80
170	180	320	76	0	76

* DMF = N,N-dimethyl formamide.

by direct radiation or by interaction with a polymeric free radical. The relevant experimental data supporting this suggestion is collected in Table 2.

Furthermore, an analysis of the amount of methyl methacrylate and styrene converted by 2 MeV electrons under grafting conditions indicates that it is much higher than would be expected for these monomers if the known dependence of polymerization rate on the half power of the intensity (17) is extrapolated to the very high intensities involved (the instantaneous intensity of 2 MeV electrons equals 10^8 rads/min.). According to Table 3, the rate of polymerization under grafting conditions using 2 MeV electrons is equivalent to the rate of polymerization using an intensity of about 10^4 rads/min. of gamma rays. This effect may be attributed to the accelerating influence of a highly viscous phase on the conversion rate, and is comparable to a Trommsdorf effect. It is of considerable commercial importance since it renders possible the use of high intensity electric machines, the utility of

TABLE 2

G. VALUE FOR RADICAL INITIATION*

Methyl methacrylate	Styrene	Ratio	Reference
27.5	1.6	18.0	(21)
5.74	0.4	12.5	(17)
3.14	0.22	14.0	(9)

* Number of radicals formed per 100 electron volts.

HOMOPOLYMERIZATION RATE: % CONVERSION PER HOUR AT 100 RADS/MIN.

Methyl methacrylate	Styrene	Ratio	Reference
2.2	0.09	25 (20° C.)	(22)
49.9	5.84	8 (72° C.)	(17)
21.1	1.01	20 (25° C.)	(17)
7.25	0.24	30 (— 18° C.)	(17)

AMOUNT OF DEPOSITED POLYMER ON POLYTHENE

Methyl methacrylate		Styrene	
Dose megarads	% Deposited	Dose megarads	% Deposited
0.2	3.1	2	2.2
0.4	11.7	4	4.7
0.8	12.8	8	7.4
—	—	10	9.9

NOTE.—Ratio of radiation doses required for deposition of equal amounts of the two monomers is approximately 20. (Compare with ratio of G values and polymerization rates.)

which could not have been predicted from earlier studies on polymerization and grafting using low intensity gamma sources.

Variation of temperature during direct grafting influences the reaction rate, the degree of swelling of the polythene and the rate of diffusion. In general, an increase in temperature leads to a higher weight fraction of deposited material but this may not necessarily be fully grafted to the substrate.

The problems of diffusion control become still more stringent with the newer varieties of high density polythene. Here, the content of amorphous material is much lower, allowing smaller sorption of all monomers. The grafted material is unable to swell uniformly during the intermittent immersion technique and this may lead to crazing and cracking of the specimen with a consequent reduction in strength. The properties of grafted high density and low density polythenes are compared in a later part of this paper.

Peroxide Method

The presence of oxygen has a marked influence on the chemical reactions occurring in polythene during irradiation. The degree of crosslinking is reduced in favour of the formation of peroxide bridges, hydroperoxide groups and carbonyl groups. All the oxygen present in an undegassed polythene specimen is removed by a dose as low as 0.1 megarad. When the sample is in the form of a thin film, however, and exposed to low intensity radiation in the presence of air, then it is possible for the oxygen to diffuse in fast enough to maintain a steady concentration. The film containing peroxide groups distributed at random throughout the structure is relatively stable at room temperature, but if heated to about 150° functions as a conventional polymerization initiator. Decomposition in the presence of oxygen-free monomer leads to initiation of new polymer chains linked to the polymeric backbone as shown in Fig. 3. Some results utilizing this technique with acrylonitrile as the monomer are shown in Table 1 (*c*). Extraction of these products with dimethyl formamide failed to strip any of the deposited polymer, which may therefore be regarded as fully grafted to the polythene.

The method has been used by Chapiro (18) to obtain a copolymer containing 122 times the original weight of the irradiated polythene while a 19-fold weight increase occurred when methyl methacrylate was employed as the monomer. An interesting feature is that despite the large weight increase, the geometric form of the original polythene is retained. The speed of the grafting reaction and the structure of the copolymer can be modified by either varying the temperature at which the pre-irradiation is carried out (which determines the number of active centres produced) or by varying the temperature of the subsequent grafting operation. This leads to the possible synthesis of copolymers of identical chemical composition but differing in the length and number of branches. From the work of Lecel (19) it is known that the lengths and numbers of branches can have considerable influence on the physical properties of graft copolymers of the same chemical composition. In theory, a more homogeneous graft copolymer should result from the grafting of acrylonitrile to polythene while the latter is held above its crystalline melting point. It is true that under these conditions the monomer

TABLE 3

COMPARISON BETWEEN HOMOPOLYMERIZATION AND GRAFTING

Methyl methacrylate			Styrene		
Intensity rads/min.	mg./g. per megarad	Hours per megarad	Intensity rads/min.	mg./g. per megarad	Hours per megarad
10^2	3,500* (*b*)	167.0	10^2	125* (*b*)	167.0
10^3	800* (*b*)	17.0	10^3	30* (*b*)	17.0
10^4	200* (*b*)	1.7	10^4	7* (*b*)	1.7
0.2 x 10^6 rads per pass at minute intervals	200† (*a*) 1,300† (*b*)	0.1 0.1	10^6 rads per pass at minute intervals	12† (*a*) 60† (*b*)	0.02 0.02

* Homopolymerization. † Grafting. (*a*) Based on total grafted material. (*b*) Based on monomer.

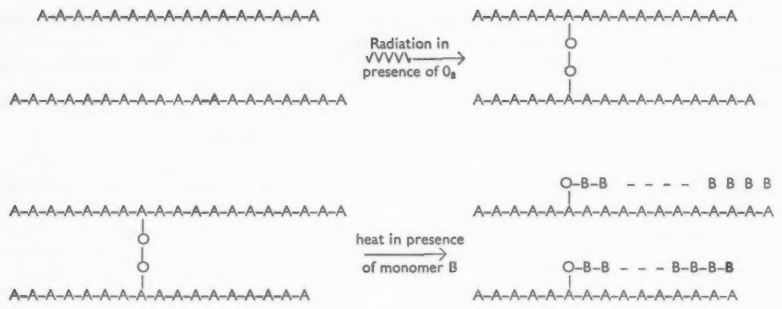


FIG. 3

is more able to penetrate the film uniformly. The product nevertheless differs little from a graft copolymer of the same composition made by the direct method. The reason for this is that although the film is in the amorphous condition during grafting, it is in the crystalline condition during the pre-irradiation. Oxygen is no more able to diffuse through the crystalline regions of polythene than monomer molecules. As a result, the peroxide groups are located in the amorphous regions. On subsequent grafting, this compels the acrylonitrile chains to be linked to the polythene in what was originally the amorphous regions and the grafted material may still form spherulites of comparable size on cooling (20). If very large amounts of a monomer such as methyl methacrylate are grafted to polythene, then it is possible that the grafted sidechains will prevent re-crystallization of the polythene segments and that the product will be transparent.

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Trays in the Sky

THE last ten years have seen great advances in all plastic materials and techniques. Foremost among these are the development on the one hand of thermoplastic sheeting material, and on the other hand a corresponding improvement in the technique of vacuum forming. The two, as it were, go hand in hand. High impact polystyrene sheeting is now too well known in its general form to need any introduction, but the development of Iridon decorative H.I.P.S. (as it is commonly referred to) has opened up new applications for plastics. The five attractive trays illustrated here have been especially manufactured for airline service by A. Fifer Ltd., Buckingham Avenue, Trading Estate, Slough, Bucks. Measuring 10 in. × 15 in. with a depth of just over ½ in. and a flange of about the same size on the handling edges, they meet full airline requirements from the point of view of essential lightweight and price factors as well as in the striking quality of the designs. Two of the patterns, the woodgrain and blue fleck, are traditional and imitative designs, commonly found in a wide variety of plastic surfacing materials, and they present nothing new. Mambo, however, and perhaps to a lesser extent pebbledash and filigree, have an unmistakeable feeling for the material with which they are associated. They are neither directly imitative nor too closely suggestive of natural or other manufactured materials, and Iridon are to be congratulated in having had the initiative to break away from the traditional and to give these trays a character which is properly their own.

Several features, not only of the trays, but also of high impact polystyrene itself, are of particular interest. Iridon decorative high impact polystyrene carries its printed pattern below the actual surface of the material and so it cannot chip, flake, be scratched or wear away. The process, say the manufacturers, is extremely difficult technically. They claim they are the only producers in this country to sandwich a printed design between a clear film and the actual polystyrene, thus presenting a homogeneous and virtually inseparable decorative material suitable for vacuum forming.

The trays are equally at home in aeroplanes or Espresso bars and for the early morning cup of tea. They have a non-slip finish on the reverse which is not only functional from the point of view of safety, but also breaks up, by the texture of the embossing, the rather cold appearance which expanses of white, whether plastic or enamel, tend to have.

The weight of a tray is approximately 9 oz., which is almost half that of an equivalent decorative metal tray.

Clearly the applications for Iridon decorative high impact polystyrene go well beyond the limits of tray manufacture. It may be extensively used in television sets and wirelesses, in refrigerators and display units, and its easily cleaned surface makes it ideal as a wall panelling.

Airline trays manufactured from Iridon high impact polystyrene sheet, by A. Fifer Ltd. Detailed information about this sheet material is available from Iridon Ltd., 1 Avery Row, London, W.1.

Patent Review

The following abstracts have been made from specifications at the Patent Office, with the permission of the controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 3s. 6d. each (including postage).

B.P. 780,667. Methods of and apparatus for conditioning resin impregnated fibrous mats for moulding operations. Ashdowns Ltd., F. W. Silverwood.

When forming mats of glass fibres impregnated with polyester resin for bonding air must be excluded. This is achieved by laying the mat on an under sheet (regenerated cellulose) which is air impermeable, and applying at an angle progressively a like covering sheet using vibratory compressive forces behind the application of the covering sheet.

B.P. 780,677. Process and apparatus for making reinforced plastic bars, tubes and like elongated stock. To: H. I. Thompson Fiber Glass Co.

An elongated fibrous body (loose rovings of glass or nylon fibres) are impregnated with a thermosetting liquid plastic (polyester, phenolic, diallylphthalate, silicone, epoxy, etc.) and continuously pulled through a shaping die maintaining it under lateral compression and polymerizing the plastic content by dielectric heating while the body passes through the die. The die may be formed of polytetrafluoroethylene.

B.P. 780,690. Apparatus for wrapping an article in thermoplastic sheet material. H. Rumsey, Jr., Glaz-Wrap Packaging Co.

The sheet is drawn from a roll and cut by a heated wire or blade. The cut edge of the roll is retracted from the wire so as not to be damaged by the heat.

B.P.780, 693. Closures for containers. L. Gruber (Switzerland).

A screw cap (for bottles, collapsible tubes, etc.) with an opening in its top and an insert between cap and neck. The cap need not be removed for dispensing. Formation of drops on top of the cap when screwed tight after dispensing is prevented by the shape of the insert and a recess in the cap. The insert is made, e.g., of polyethylene.

B.P. 780,795. Supporting dressings for broken bones and other injured parts. A. R. B. Furendal, B. Thuresson af Ekenstam, B. N. F. von Fieandt AB Bofers.

A dressing non-absorbent to X-rays is made by coating a bandage of textile material with an emulsion of a hard synthetic resin and an emulsion of a soft resin as a binding agent to fix the particles of the hard resin after drying to the textile material. The hard resin may be polymethylmethacrylate, polyisobutyl-methacrylate, polythyrene. The soft resin polynonylmethacrylate, polyethylacrylate, polybutylacrylate. After application, the bandage is treated with a solvent, then dried.

B.P. 780,847. Protective apron for baths, wash-basins or sinks. E. S. Moreland, L. M. Munro.

A thin sheet of plastic to be suspended from a tap to prevent staining of the basins, etc., by dripping water.

B.P. 780,887. Dispensers for adhesive tape and the like. J. K. Thompson.

With a cutting device and a device for folding over the new free end to form a tab.

B.P. 780,900. Method of and apparatus for forming and/or shaping tubing or other tubular workpieces of thermoplastic material. H. Reifenhäuser (Anton Reifenhäuser) (Germany).

The continuously extruded tube is maintained at softening temperature while a vacuum is applied to the outer surface of the delivered tube. The extent of the subsequent expansion of the tube is limited by a tubular enclosure and the expanded tube is then cooled while still in contact with this member to be hardened without losing its shape.

B.P. 780,994. Closures for bottles. D. L. Wiggins.

The (polyethylene, nylon, " Teflon ") stopper is made with a thin dependent flange underneath the head forming a gas-tight seal in the neck when the stopper is screwed down.

B.P. 781,093. Side pieces for spectacles. S. H. Bressy, M. Duployer.

Rings near the articulation point for decoration.

B.P. 781,103. Dispensing containers. J. H. Pool. To: International Patents Trust Ltd.

A round polythene container with axial corrugations of sufficient radial flexibility to enable it to be turned partially outside in for dispensing by pressure on the bottom.

B.P. 781,128. Method of producing permanent magnets bonded with synthetic plastic. M. Baermann (Germany).

B.P. 781,161. Coloration of polymers and copolymers of vinylchloride. To: S. A. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey (France).

Uniform colouring is achieved by incorporating a previously prepared dye or pigment concentrate of a mixture of dye or pigment with a plasticized polymer or copolymer of vinyl chloride having a working temperature below that of the polymer or copolymer to be coloured.

B.P. 781,171. Moulded plastic articles and processes of making same. M. A. Coler, A. S. Louis. To: Markite International Corp.

Electrostatic charges built up on ejection of certain plastics from the mould result in attraction of dust which when wiped off may lead to scratches. By adding a destaticizing agent (polyhydric alcohols, etc.) and a finely divided sorptive material (e.g. silica gel) in certain proportions, an antistatic moulded plastic composition can be obtained.

B.P. 781,184. Manufacture of transparent cellulose sheets and films. E. G. Sanderson. A. Maloney. To: Brit. Cellophane Ltd.

The tendency of sheets to stick together is eliminated or reduced by applying a thin coating of an anti-sticking agent, i.e. an aqueous solution of a salt of an aliphatic amine liquid at 25 deg. C. or its liquid reaction product with ethylene oxide which is dried afterwards.

B.P. 781,203. Coated films. To: Celanese Corp. (U.S.A.).

Cellulose acetate films are rendered heat sealable by an intermediate coating (under the heat sealing composition) of an N: N'-di-(alkoxymethyl)-ethylene-urea (or thio-urea).

B.P. 781,301. Non-metallic tubes or other hollow bodies. G. B. Cunning. To: T.I. (Group Services) Ltd.

Hollow bodies produced from glass or other such filaments bonded together by a liquid, hardened by heat treatment are made non-porous by incorporating a thin plastic (thermosetting) lining preformed on a removable mandrel.

B.P. 781,337. Method of treating filaments of plastic, for use in paint or like brushes. A. S. Leng.

Waves are formed in the filaments which vary in extent and position from filament to filament. When the filaments are mixed together and mounted in a brush they apply paint, etc., in a manner similar to natural bristles.

B.P. 781,338. Holders for drinking glasses, beakers and the like. G. A. Elliot. To: B.E.F. Products (Essex) Ltd.

A plastic holder with fingers bulged inwardly to a ring around the glass of resiliently yieldable grip.

B.P. 781,351. Water-resistant phenolic resin bonded abrasive structure. R. S. Daniels, A. J. Mostello. To: Union Carbide and Carbon Corp. (U.S.A.).

B.P. 781,361. Method and apparatus for edge sealing glass sheets. To: Libbey-Owens-Ford Glass Co. (U.S.A.).

A laminate of glass sheets with an interposed plastic sheet is evacuated and put under pressure. Then the marginal areas of the thermoplastic sheet are heated to a higher temperature than the adjacent glass so that they become adhesive and effect a seal.

B.P. 781,377. Moulding plastic articles. M. A. Coler, A. S. Louis, H. A. Gottschall. To: Markite International Corp.

Diverse plastic materials can be moulded into an integral body if the materials are ground to powders finer than 60 mesh (preferably 100 mesh) and if the particles produced are irregular.

B.P. 781,443. Manufacture of flexible strip material. A. T. Kinder, K. W. Brook. To: Metropolitan-Vickers Electrical Co., Ltd.

For conveyor belting in mines where static electric charges increase fire risk. Three or more (five) layers of textile material impregnated with a thermoplastic material are superimposed and secured by a binding layer around the edges of the same thermoplastic material. High frequency dielectric heating is applied under mechanical pressure to hold the layers of the assembly together (see also B.P. 781,446).

B.P. 781,449. Drier compositions for use in coating compositions containing drying oils and/or synthetic resins. To: Carlisle Chemical Works Inc. (U.S.A.).

The booser drier is a zirconium salt (a zirconyl 2-ethyl hexoate).

B.P. 781,452. Polymeric organo-tin mercapto compounds and synthetic resins containing the same. To: Carlisle Chemical Works Inc.

A heat and light resistant halogen-containing synthetic resin.

B.P. 781,467. Method of improving the bonding properties of solid polyethylene plastic materials. C. R. Bruce, T. N. Williams. To: Brit. Cellophane Ltd.

The receptivity to printing inks and to adhesives is increased by the application of a coating of a naturally occurring resin (gum dammar, East India gum, Batu resin, gum

elemi) or the wax form or the dewaxed form of the resin, each having an acid value of not more than 50 and a saponification value of not more than 60.

B.P. 781,469. Rigid polyester-urethane thermoplastics. B. F. Goodrich Co. (U.S.A.).

Useful as an adhesive to form structures (with metals, ceramics, rigid plastics).

B.P. 781,489. Method for coating of fibrous materials such as glass threads with synthetic resin. To: Institut Textile de France (France).

The material is first coated with a di-ethylene-urea compound, then the threads or fabrics are coated with a mixture including the di-ethylene-urea compound, an organic di-isocyanate and the synthetic resin in question, finally heating the coated threads or fabrics. This method overcomes the tendency of the resin to break away from the glass fabric.

B.P. 781,541. Dispensing device for dispensing pastes, liquids and the like. D. A. Moir, G. S. Webber (Australia).

For a collapsible tube. An elastic barrel-shaped ring nut with an interior flange in the middle and on one side of the flange connected or integral with it a resilient tubular elongated member with a slit in the rounded top. The member forms a tight closure when the nut is screwed on with the member inside the neck and a non-return valve when the nut is screwed on the other way round with the member projecting outside.

B.P. 781,560. Machines for making hollow plastics articles. To: L. & I. Glenn Proprietary Ltd. (Australia).

A reciprocating type injecting machine in which the existing nozzle and the mould parts disposed between fixed and movable platens are replaced by a nozzle and a two-part mould projecting into the space between fixed and movable platens and terminating at its outer end in a die head within which a hollow core is located. Heat plasticized material is delivered into the open mould as a tubular body which is nipped off on closing of the mould. Then compressed air is introduced to expand the body against the mould walls (add 780,439).

B.P. 781,691. Cushions, mattresses and like resilient supports. To: Dunlop Rubber Co., Ltd. (Germany).

A body portion of a resilient cellular material (e.g., polyurethane foam, expanded plasticized polyvinyl chloride composition) of which at least one edge is covered by an angle strip which is less easily compressed than the main body.

B.P. 781,698. Stores dropping platforms. Blackburn & General Aircraft Ltd., F. M. Clark, J. T. Stamper.

Surface sheets spaced by low density filling material such as resin bonded honeycomb paper, foamed plastic, etc., in a light metal framework as shock absorbers on contact with the ground.

B.P. 781,731. Phenolic resin plywood glues. W. McG. Morgan. To: Monsanto Chemicals Ltd.

Staining of the wood can be reduced by the incorporation of a salt of silicofluoric acid.

B.P. 781,925. Methods of making hollow bodies from fibrous material and heat-hardenable resin. H. J. Pollard, W. A. Baker. To: Bristol Aircraft Ltd.

A former a little smaller than the cavity of the hollow body is used as a preliminary support for the fibrous material. This material is more easily applied to the former, which can be rotated during application, from the outside than inside the moulding tool. Two or more formers may be used with one moulding tool.

B.P. 781,979. Vacuum deep-drawing of thermoplastic sheet material. R. Northmore. To: Hydro-Chemie A.G.

Deep-drawing of a sheet of, e.g., polyvinyl-chloride over a perforated mould or die is facilitated by a valve arrangement in which the maximum vacuum is applied to the take-off pipe just prior to the material being drawn tightly against the mould. Usually the maximum vacuum is applied at the beginning and then drops off so that very large exhausters are required.

B.P. 781,983. Apparatus adapted to operate upon powder deposited upon a mould member. To: British United Shoe Machinery Co., Ltd. Comm. from: United Shoe Machinery Corp.

Synthetic resins are impervious to moisture and therefore have a cold " feel " to the hand as against the warm " feel " of leather. They are not accepted for high grade articles touched frequently (handbags, upholstery). In shoes, their use is limited because they are incapable of dissipating moisture. Microporous resinous sheets have been made but as soles are uncomfortable owing to their irregularity. Uniform thickness and uniform density can, however, easily be obtained by depositing powder on a mould in a frame and moving frame and mould against one another while a doctor blade levels the upper surface. Particles of powder separated by the blade are removed by suction.

B.P. 781,986. Method of fixing attachments to flexible sheet plastics. D. W. R. Walker.

A piece of textile material is applied on certain areas to increase resistance to tearing. Plastic and textile material are fused together but so that the outer face of the textile material remains free of plastic.

B.P. 782,000. Apparatus for moulding plastic material around wires in the manufacture of switch parts of multicontact electro-magnetic relays. To: Western Electric Co. Inc. (U.S.A.). The wires are individually supported in grooves of the bottom mould and the plastic material does not directly impinge on the wires.

B.P. 782,166. Decorative panels, shapes or articles produced by the application of wood veneers to transparent substances. A. Shelden.

A sandwich of pictorial wood-marquetry between sheets of " Perspex."

B.P. 782,203. Sealing strips. R. L. Hunter. To: Allied Ironfounders Ltd.

A one-piece moulding or extrusion to effect a watertight seal between a bath, wash basin, sink and the wall.

B.P. 782,241. Fluid tight receptacle. To: United States Rubber Co. (U.S.A.).

For water bottles with a neck rollable upon itself so that no stopper is needed.

B.P. 782,249. Playballs. H. Meyer.

Formed from two initially flat circular pieces punched from two lengths of plastic, one of which carries a printed design in heat-resistant synthetic colours. One of the lengths is colourless or provided with a grand colour, the other is at least partly transparent and carries the print. The lengths are welded together so that the print is inside and visible through the transparent piece.

B.P. 782,302. Holders for jewellery and other articles. F. Wheatley, Jr. To: Richard Wheatley & Son, Ltd.

B.P. 782,383. Reinforced plastics. To: Celanese Corp. of America (U.S.A.).

A plurality of layers of fibrous material bonded to form a laminate. Artificial fibres are incorporated in the outer face made from a composition in which there is suspended a white or coloured pigment insoluble in the fibre-forming material. This makes it possible to produce a design.

B.P. 782,393. Thermosetting coating compositions curable at room temperature. To: Fenolic International Inc. (U.S.A.). For coating cellulosic materials (wood, paper, cloth, cardboard). The composition comprises a thermosetting resin, an alkyd resin, a thermoplastic resin, and a small amount of an acid catalyst for curing the thermosetting resin.

B.P. 782,401. Marking indicia on soft plastic strip material. To: American Cyanamid Co. (U.S.A.).

Adapted for the manufacture of soft plastic capsules.

B.P. 782,455. Manufacture of moisture-resistant coated films of regenerated cellulose. To: Kalle & Co. A.G. (Germany).

Regenerated cellulose base films are impregnated with anchoring agents which are water-soluble reaction products of phosphorus oxychloride and alkylene or of phosphorus thiotrichloride and alkylene imines, and are subsequently coated with a moisture resistant surface coating.

B.P. 782,481. Shaped articles of porous styrene polymers having impact-resistant surfaces and a method for the production of such shaped articles. To: Badische Anilin & Soda Fabrik A.G. (Germany).

The articles consists to the extent of at least about 51% of their volume of a porous, cellular styrene polymer and have a surface reinforcement of a copolymer of an unsaturated polyester resin and a vinyl compound liquid at room temperature. As insulating materials, floats, crash helmets, building elements.

Standard for Flexible Insulating Sleeving

THIS British Standard is based on information supplied by the British Electrical and Allied Industries Research Association.

It specifies requirements for a range of flexible insulating sleeving of circular section, intended primarily for insulating electrical conductors and the connections of electrical apparatus. The sleeving may be made by varnishing or coating a textile base; or by extruding suitable insulating materials, with or without a textile base.

Some of the types of sleeving dealt with in the standard (especially the larger sizes) are also suitable for covering and holding together a number of conductors which are already individually insulated.

In selecting from the number of different types specified, the most suitable sleeving for a particular purpose, consideration should be given to such general factors as operating temperature range, electrical requirements, climatic conditions, degree of fire resistance and the need for mechanical reinforcement, i.e. external braid. Tests for all these factors are dealt with in appendices to the standard.

The standard points out that other considerations to be borne in mind are the possible effects of impregnating media and of oil and other liquids with which the sleeving may come into contact.

Copies of this standard, B.S. 2848: 1957, may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 6/–.